Maintenance and Service Guide

HP MultiSeat ms6200 and HP t200 Zero Client For MultiSeat

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HP Business PC Maintenance and Guide

HP MultiSeat ms6200 and HP t200 Zero Client For MultiSeat

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About This Book

WARNING! Text set off in this manner indicates that failure to follow directions could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

NOTE: Text set off in this manner provides important supplemental information.

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1 Product Features

HP MultiSeat ms6200

Standard Configuration Features

Features may vary depending on the model. For a complete listing of the hardware and software installed in the computer, run the diagnostic utility (included on some computer models only).

Figure 1-1 Small Form Factor Configuration

NOTE: The MultiSeat computer can also be used in a tower orientation. For more information, see Using the Small Form Factor Computer in a Tower Orientation on page 75 in this guide.

Front Panel Components

Drive configuration may vary by model. Some models have a bezel blank covering one or more drive bays.

Figure 1-2 Front Panel Components

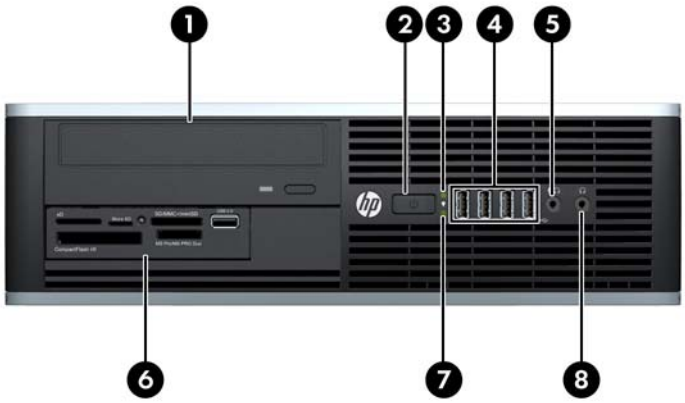


Table 1-1 Front Panel Components

1	5.25-inch Optical Drive	5	Microphone/Headphone Connector
2	Dual-State Power Button	6	3.5-inch Media Card Reader (optional)
3	Power On Light	7	Hard Drive Activity Light
4	USB (Universal Serial Bus) Ports	8	Headphone Connector

NOTE: The Power On Light is normally green when the power is on. If it is flashing red, there is a problem with the computer and it is displaying a diagnostic code.

Media Card Reader Components

The media card reader is an optional device available on some models only. Refer to the following illustration and table to identify the media card reader components.

Figure 1-3 Media Card Reader Components

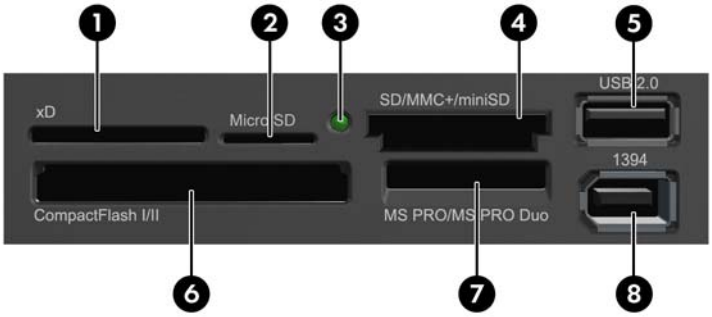
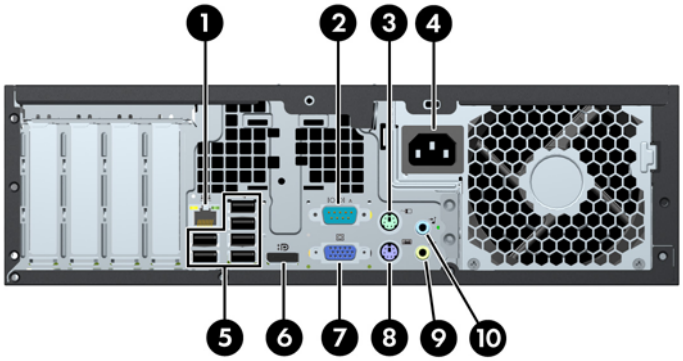


Table 1-2 Media Card Reader Components

No.	Slot	Media		
1	**xD**	• xD-Picture Card (xD)		
2	**MicroSD**	• MicroSD (T-Flash)	• MicroSDHC	
3	**Media Card Reader Activity Light**			
4	**SD/MMC+/miniSD**	• Secure Digital (SD) • Secure Digital High Capacity (SDHC) • MiniSD	• MiniSDHC • MultiMediaCard (MMC) • Reduced Size MultiMediaCard (RS MMC)	• MultiMediaCard 4.0 (MMC Plus) • Reduced Size MultiMediaCard 4.0 (MMC Mobile) • MMC Micro (adapter required)
5	**USB**	• USB (Universal Serial Bus) Port		
6	**CompactFlash I/II**	• CompactFlash Card Type 1	• CompactFlash Card Type 2	• MicroDrive
7	**MS PRO/MS PRO DUO**	• Memory Stick (MS) • MagicGate Memory Stick (MG) • MagicGate Memory Duo	• Memory Stick Select • Memory Stick Duo (MS Duo) • Memory Stick PRO (MS PRO)	• Memory Stick PRO Duo (MS PRO Duo) • Memory Stick PRO-HG Duo • Memory Stick Micro (M2) (adapter required)
8	**1394**	• 1394 Port (available on select models only)		

Rear Panel Components

Figure 1-4 Rear Panel Components



1		RJ-45 Network Connector	6		DisplayPort Monitor Connector
2		Serial Connector	7		VGA Monitor Connector
3		PS/2 Mouse Connector (green)	8		PS/2 Keyboard Connector (purple)
4		Power Cord Connector	9		Line-Out Connector for powered audio devices (green)
5		Universal Serial Bus (USB) ports	10		Line-In Audio Connector (blue)

Serial Number Location

Each computer has a unique serial number and a product ID number that are located on the top cover of the computer. Keep these numbers available for use when contacting customer service for assistance.

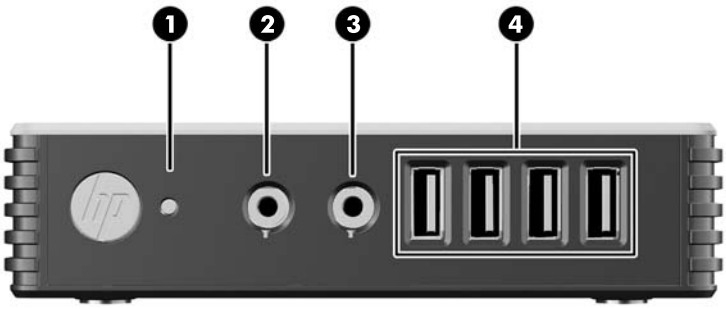
Figure 1-5 Small Form Factor Serial Number and Product ID Location

HP t200 Zero Client

Front Panel Components

For more information, http://www.hp.com and search for your specific t200 Zero Client model to find the model-specific QuickSpecs.

Figure 1-6 Front panel components

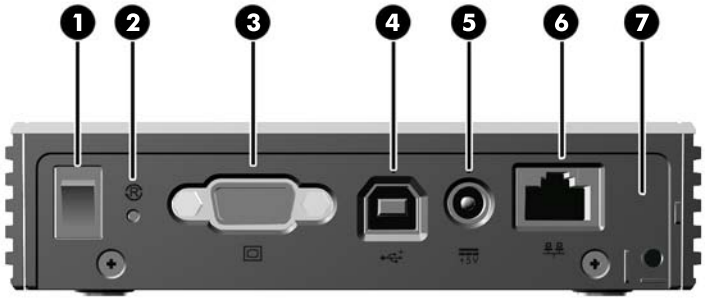


(1)	Power LED	(3)	Line-out (headphone) audio connector
(2)	Line-in (microphone) connector	(4)	USB 2.0 connectors (4) **NOTE:** If the optional DC adapter is not connected, the t200 Zero Client supports a standard USB keyboard and USB mouse plus one 100 mA USB device (low power), such as some flash drives. If the optional DC adapter is connected to a working power outlet or to the monitor, the t200 Zero Client supports a USB keyboard, a USB mouse, and two 500 mA (high power) USB devices. HP monitors with power-pass-through (such as the HP LE1851wt 18-inch Widescreen LCD Monitor) can supply power to the t200 Zero Client.

Rear Panel Components

For more information, http://www.hp.com and search for your specific t200 Zero Client model to find the model-specific QuickSpecs.

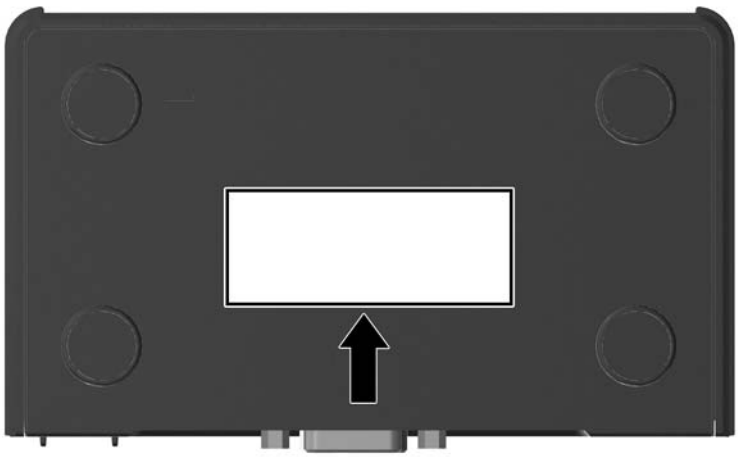
Figure 1-7 Rear panel components



(1)	On/off switch	(5)	DC power connector
(2)	Reset button	(6)	Ethernet RJ-45 connector
(3)	VGA connector	(7)	Security clip slot
(4)	USB PC connector to host PC (USB Type A/B cable included)		

Serial Number Location

Figure 1-8 Serial number location



Every t200 Zero Client includes a unique serial number located as shown in the following illustration. Have this number available when contacting HP customer service for assistance.

2 HP MultiSeat Computing Solution – Best Practices

Offerings of Microsoft® Windows® MultiPoint™ Server 2011

OEM Standard

- HP MultiSeat ms6200 Desktop (the host PC) ships preinstalled from the factory with Windows MultiPoint Server 2011, which includes the server Certificate of Authenticity (COA) and the host station Client Access License (CAL)
- HP zero clients sell separately; client operating system CAL is included
- HP preinstalls Windows MultiPoint Server 2011 in 18 languages
- Domain join not allowed
- Operating system maximum number of users: ten (see Performance Considerations on page 14)
- Maximum memory: 8 GB

OEM Premium

- HP MultiSeat ms6200 Desktop (the host PC) ships preinstalled from the factory with Windows MultiPoint Server 2011, which includes the server Certificate of Authenticity (COA) and the host station Client Access License (CAL)
- HP zero clients sell separately; client operating system CAL is included
- HP preinstalls Windows MultiPoint Server 2011 in 18 languages
- Domain join allowed
- Operating system maximum number of users: 20 (see Performance Considerations on page 14)
- Maximum memory: 16 GB

Academic Volume License

- HP MultiSeat ms6200 Desktop sold with FreeDOS installed and no Client Access License (CAL) provided
- Requires the purchase of the Academic Volume License version of MultiPoint Server 2011
- Device drivers must be downloaded from HP and installed
- HP zero clients do not include the user CAL
- Available in multiple languages: 18 fully localized, 20 with operating system localized (MultiPoint Manager is not localized)
- Domain join allowed
- Operating system maximum number of users: 20 (see Performance Considerations on page 14)

Description of Modes

Microsoft Windows MultiPoint Server 2011 can operate in two different modes described below:

- Maintenance, see Maintenance on page 8
- Normal, see Normal on page 8

Maintenance

Maintenance mode is the state of the MultiPoint Server 2011 system in which the administrative user performs maintenance tasks. No stations switch to this mode—this mode ends all user sessions. All software and driver installations are performed in Maintenance mode, including updating system settings.

Maintenance Mode can be accessed by choosing "Switch to Maintenance Mode" from within the MultiPoint Manager.

Normal

Normal mode is the default mode. Users normally log in and perform individual task on each station in Normal mode. Each session runs a separate RDP session. Software updates and driver installations should not be performed in Normal mode.

Remapping Stations

MultiSeat uses an auto-mapping function to associate each attached zero client. If the auto-mapping function fails to work, then the user can manually associate their workstation with this function. Auto-mapping does not apply to the host PC station. The remap function could be used to reconfigure the host PC station’s association if the configuration has changed.

To perform this action, choose "Remap all stations" from the MultiPoint Manager.

Topology

- Windows MultiPoint Server 2011
  - Windows MultiPoint Server 2011 supports PS/2 keyboard/mouse on the host system.
  - Windows MultiPoint Server 2011 supports audio and microphone on the host PC station.

    NOTE: For this to function, the host stations must be configured using PS/2 keyboard and mouse. It will not function with USB keyboard or mouse.
  - Windows MultiPoint Server 2011 supports daisy-chaining of client devices connected by USB cable. Daisy-chaining can simplify cabling and extend the distance between the host and a station without additional USB hubs.

    NOTE: Daisy-chaining is not supported for Ethernet-connected zero clients.

    HP supports no more than three client devices per chain.

    All clients in the chain must be AC powered.

NOTE: The maximum cable length supported by USB 2.0 specification is five meters.

You cannot mix t100 or t150 clients with t200 Zero Clients connected to the same MultiSeat host PC, but you can mix t100 and t150 client devices.

- HP MultiSeat Thin Client t100 Series (t100 and t150 client devices)
  - All t100 series client devices are connected by USB cable directly to the host system.
  - The MultiSeat Thin Client t100 has ports for PS/2 keyboard/mouse, microphone, speakers/headphones, and a VGA monitor.
  - The MultiSeat Thin Client t150 has two USB ports and a power connector, which can be used with an AC adapter or with an HP monitor with power-pass-through (such as the HP LE1851wt 18–inch Widescreen LCD Monitor). (AC adapter and monitor are sold separately).
  - If the optional DC adapter is not connected, the t150 client supports only one 100 mA USB device (low power), such as some flash drives.
- HP t200 Zero Client for MultiSeat

NOTE: The host PC must be an HP MultiSeat ms6200 Desktop. The t200 Zero Client is not supported with the HP MultiSeat ms6000 Desktop.

  - The t200 Zero Clients may be connected by Ethernet or by USB cable directly to the host system.
  - The t200 Zero Client has ports for Ethernet, microphone, speakers/headphones, and a VGA monitor.
  - The t200 Zero Client has four USB ports and a power connector, which can be used with an AC adapter or with an HP monitor with power-pass-through (such as the HP LE1851wt 18–inch Widescreen LCD Monitor). (AC adapter and monitor are sold separately).
  - If the optional DC adapter is not connected, the t200 Zero Client supports a standard USB mouse and keyboard and one 100 mA USB device (low power), such as some flash drives.

If the optional DC adapter is connected to a working power outlet or to the monitor, the t200 Zero Client supports a USB keyboard, a USB mouse, and two 500 mA (high power) USB devices.

Topology Examples

- HP MultiSeat Thin Clients t100 Series
  - Six sessions: five t100 series clients connected directly to the host PC + host station
  - Ten sessions: nine t100 series clients connected directly to the host PC + host station (configured with PS/2 mouse and keyboard)
- HP t200 Zero Clients for MultiSeat
  - Five sessions: four t200 Zero Clients connected directly via USB cable to the host PC + host station
  - Six sessions: five t200 Zero Clients and the host station, each connected to the LAN (local area network) via Ethernet cable
  - Seven sessions: three t200 Zero Clients daisy-chained (the first connected to the second which is connected to the third which is connected directly via USB cable to the host PC + host station) and three t200 Zero Clients and the host station, each connected to the LAN via Ethernet cable

Private USB

Windows MultiPoint Server 2011 now provides private USB functionality on client stations. For example, a USB flash drive connected to a USB port on a t150 client or a t200 Zero Client will be accessible only to the user on that station. A USB flash drive connected to the host PC, however, will be accessible to all users. Refer to the Microsoft TechNet page for details of the behavior with various USB device types.

Qualified USB Hubs

- Belkin 4-port, powered USB 2.0 hub: HP p/n A519110
- Belkin 7-port, powered USB 2.0 hub: HP p/n A519109
- Belkin 7-port, lighted hub: vendor p/n F5U700-BLK
- Belkin Hi-Speed USB 2.0 4-port lighted hub: vendor p/n F5U403TTBLK

Best Practices for Setting Up a MultiSeat Environment

A USB-connected environment is ideal when plug-and-play simplicity is desired or in settings with no Ethernet network infrastructure. An Ethernet-connected environment is ideal when the distance needed between the host PC and its clients must be greater than USB allows. It can also help reduce cable clutter around the host PC.

NOTE: If the t200 Zero Client drivers are not preinstalled on your host PC, please download them from the HP website. Go to hp.com, click **SUPPORT & DRIVERS**, click **Drivers & Software**, type the host PC model number (**ms6200**) in the field, and click **SEARCH** to find the latest t200 Zero Client drivers.

USB-connected MultiSeat Environment

This setup is suitable for either t100 series clients or t200 Zero Clients.

NOTE: You cannot mix t100 series clients and t200 Zero Clients connected to the same MultiSeat host PC, but you can mix t100 and t150 client devices.

▲ Connect the zero clients to the host PC:

- Connect singleton zero clients (not in a daisy chain) via USB cable directly to the host PC.
- To connect zero clients in a daisy chain, connect each client via USB cable to the next, and then connect one end of the daisy chain via USB cable to the host PC.

  NOTE: Up to three zero clients may be connected by USB cable in a daisy chain.

  Each zero client in a daisy chain must be powered using the optional power adapter connected to an AC power source or an HP monitor with power-pass-through.

Ethernet-connected MultiSeat Environment

This setup is suitable for the t200 Zero Client only.

- Daisy chaining off an Ethernet-connected zero client is not supported.
- With no USB connection to supply power, zero clients must have another source of power: either an optional power adapter connected to an AC power source or an HP monitor with power-pass-through.
- An Ethernet network infrastructure is required.
  - This should be a 100 Mb or one Gb system.
  - DHCP is highly recommended.
  - Can only see t200 Zero Clients on same subnet as host PC.

- Ethernet-connected t200 Zero Clients look like local USB devices to the operating system as displayed in MultiPoint Manager.
- There are two types of hardware reset:
  - Clear assignment—hold recessed reset button while powering on until LED blinks blue/amber
  - Clear all (factory defaults)—hold the reset button for seven seconds until the LED goes out. This does not need to be during power on, but the device must NOT be connected to a host (according to the **Network Stations** tab in MultiPoint Manager).

1. Connect the host PC to the LAN via Ethernet cable.
2. Connect the t200 Zero Clients to the LAN via Ethernet cable.
3. (Recommended) Power on one at a time or small groups at a time.
4. (Recommended) In the **Network Stations** tab of the MultiPoint Manager, change the Name and/or Location.
5. (Recommended) Label each unit.
6. Use one of two methods of assigning t200 Zero Clients to a host PC:
   - Client-based (hotkey)
   - Host-based (GUI)

Client-based (hotkey) Assignment

1. In the **Network Stations** tab of the MultiPoint Manager, set up hotkeys on hosts.

   Each host in the subnet must have a unique hotkey.
2. Ensure that the t200 Zero Client is not already assigned to a host by confirming that the LED blinks alternately blue and amber. Refer to the reset methods above, if needed.
3. On the keyboard connected to the t200 Zero Client, press the key that matches the hotkey set on the host PC to which you want this client assigned.
4. Wait 30 seconds to one minute until device is ready for login.

Host-based (GUI) Assignment

1. Go to the **Network Stations** tab in MultiPoint Manager.
2. Select the client(s) you want to assign to this host.
3. Choose **Assign to this server** from the task area on the right.

NOTE: You may include USB-connected t200 Zero Clients and daisy-chained t200 Zero Clients along with Ethernet-connected t200 Zero Clients on a host PC. They must be connected as described in USB-connected MultiSeat Environment on page 11.

Best Practices for Installation of Drivers with the Volume License Operating System

Recommended Method (Automatic Driver Installation)

Before installing the Windows MultiPoint Server 2011 Volume License operating system from DVD, go to www.hp.com and search for drivers for your host PC model. Choose the MultiPoint 2011 OS then locate and download the "HP Install Assistant" Softpaq. (Using this method, you will not need to download any other driver Softpaqs.) Extract the Softpaq contents and carefully follow the included PDF instructions. This will create a USB flash drive that when inserted during the DVD install of the OS, will automatically install all of the necessary drivers.

Manual Driver Installation

If manual installation of the drivers is required, heed the following advice:

- Perform all driver and software installations in Maintenance mode.
- Do not connect the client to the host system until all drivers are installed.
- Install the graphics driver BEFORE installing the other drivers; otherwise, the solution may not operate correctly.
- Install all system drivers (drivers for each HP host PC models are available on the HP.com website). You do not need to download the "HP Install Assistant" Softpaq when installing drivers manually.
- Switch back into Maintenance mode as necessary until all drivers are installed.
- Use the 32-bit version of Internet Explorer® to install browser add-ons (e.g., Adobe® Flash® Player).
- Ensure that the latest Microsoft updates are installed.
- Verify that the BIOS on the HP MultiSeat host PC is the latest version to be found on HP.com.
- Follow the Quick Setup Poster sequence to connect the clients after the drivers are loaded.
- Re-launch into Normal mode when all drivers and software are installed.

Performance Considerations

Consider the following when evaluating performance on a MultiSeat solution:

- Each client session, including the host system, will offer native resolution of the monitor attached to the client/host. The MultiPoint operating system does not attempt to reduce the resolution or color depth of each session.
- Performance will be a factor of the application running in each session and the number of client sessions running per host system.
- Some Flash-enabled websites can be highly CPU-intensive, even for a single-desktop system. Understandably, running several MultiSeat terminals with Flash will cause the CPU to run very high. This in turn can cause performance degradation at the clients including, but not limited to, slow mouse and keyboard response. If this happens, reduce the number of clients until you get an acceptable response.
- The best and simplest path to gain better performance is to ensure the best fit of the MultiSeat host system, Essential or Extended configurations, with the main use of the MultiSeat solution.
- MultiPoint operating system user sessions have the Internet Explorer 8 browser installed. It is strongly recommend that compatibility mode is used to mitigate any compatibility issues with older websites.
- Next, you must ensure the best fit for the number of clients attached to each host system. The best reference for this is the Microsoft TechNet. See External Links on page 14.

Licensing and Support

Several support options are available—these must be purchased separately:

- WMS VL Support Link for Professional Customers
- Microsoft Volume Licensing Service Center (VLSC)

External Links

- HP MultiSeat Solution
- Microsoft Windows MultiPoint Server Forum
- Microsoft TechNet for Windows MultiPoint Server 2011
- Microsoft Partner Network

Troubleshooting

Windows MultiPoint is unable to display the monitor's native or recommended resolutions for some larger monitors.

Cause	Solution
The MultiSeat zero client has a lower maximum resolution than some larger monitors can display.	The maximum resolution supported by the t200 Zero Client is 2048 x 1152.

Switching from USB to PS/2 mouse or keyboard (and vice versa) requires the stations to be remapped.

Cause	Solution
The MultiPoint operating system stores the previous mapping of keyboards and mice to each display, and it attempts to continue to use that mapping.	Use the **Remap all stations** feature in the MultiPoint Manager when changing keyboard or mouse configurations in any way.

The host USB mouse has failed on some USB ports after re-associating .

Cause	Solution
Not all pairs of USB ports on the host PC can be used for a USB keyboard and mouse.	HP highly recommends using a PS/2 keyboard and a PS/2 mouse on the host PC.

WMSReserved and SRCShell user accounts are found.

Cause	Solution
These user accounts exist on purpose.	These user accounts are a critical part of the Windows MultiPoint 2011 operating system and should not be deleted or tampered with.

Auto-Logon did not work properly.

Cause	Solution
The MP2011 Auto-Login feature cannot work if the user account used does not have a password.	Set a password on the user account.

LED Codes

Table 2-1 USB-connected HP t200 Zero Client for MultiSeat

Solid amber	USB-powered
Solid blue	DC-powered

Table 2-2 Ethernet–connected HP t200 Zero Client for MultiSeat

Blinking alternately blue and amber	not assigned to a host PC
Blinking amber	looking for host that matches hotkey
Blinking blue	looking for host which is currently assigned
Solid blue	connected to assigned host

3 Computer Setup (F10) Utility

Computer Setup (F10) Utilities

Use Computer Setup (F10) Utility to do the following:

- Change factory default settings.
- Set the system date and time.
- Set, view, change, or verify the system configuration, including settings for processor, graphics, memory, audio, storage, communications, and input devices.
- Modify the boot order of bootable devices such as hard drives, optical drives, or USB flash media devices.
- Enable Quick Boot, which is faster than Full Boot but does not run all of the diagnostic tests run during a Full Boot. You can set the system to:
  - ❏ always Quick Boot (default);
  - ❏ periodically Full Boot (from every 1 to 30 days); or
  - ❏ always Full Boot.
- Select Post Messages Enabled or Disabled to change the display status of Power-On Self-Test (POST) messages. Post Messages Disabled suppresses most POST messages, such as memory count, product name, and other non-error text messages. If a POST error occurs, the error is displayed regardless of the mode selected. To manually switch to Post Messages Enabled during POST, press any key (except F1 through F12).
- Establish an Ownership Tag, the text of which is displayed each time the system is turned on or restarted.
- Enter the Asset Tag or property identification number assigned by the company to this computer.
- Enable the power-on password prompt during system restarts (warm boots) as well as during power-on.
- Establish a setup password that controls access to the Computer Setup (F10) Utility and the settings described in this section.
- Secure integrated I/O functionality, including the serial, USB, or parallel ports, audio, or embedded NIC, so that they cannot be used until they are unsecured.
- Enable or disable removable media boot ability.

- Solve system configuration errors detected but not automatically fixed during the Power-On Self-Test (POST).
- Replicate the system setup by saving system configuration information on a USB device and restoring it on one or more computers.
- Execute self-tests on a specified ATA hard drive (when supported by drive).
- Enable or disable DriveLock security (when supported by drive).

Using Computer Setup (F10) Utilities

Computer Setup can be accessed only by turning the computer on or restarting the system. To access the Computer Setup Utilities menu, complete the following steps:

1. Turn on or restart the computer.
2. Press either Esc or F10 while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.

   Pressing Esc displays a menu that allows you to access different options available at startup.

   NOTE: If you do not press Esc or F10 at the appropriate time, you must restart the computer and again press Esc or F10 when the monitor light turns green to access the utility.
3. If you pressed Esc, press F10 to enter Computer Setup.
4. A choice of five headings appears in the Computer Setup Utilities menu: File, Storage, Security, Power, and Advanced.
5. Use the arrow (left and right) keys to select the appropriate heading. Use the arrow (up and down) keys to select the option you want, then press Enter. To return to the Computer Setup Utilities menu, press Esc.
6. To apply and save changes, select **File** > **Save Changes and Exit**.
   - If you have made changes that you do not want applied, select **Ignore Changes and Exit**.
   - To reset to factory settings or previously saved default settings (some models), select **Apply Defaults and Exit**. This option will restore the original factory system defaults.

CAUTION: Do NOT turn the computer power OFF while the BIOS is saving the Computer Setup (F10) changes because the CMOS could become corrupted. It is safe to turn off the computer only after exiting the F10 Setup screen.

Table 3-1 Computer Setup (F10) Utility

Heading	Table
File	Computer Setup—File on page 18
Storage	Computer Setup—Storage on page 19
Security	Computer Setup—Security on page 21
Power	Computer Setup—Power on page 25
Advanced	Computer Setup—Advanced on page 26

Computer Setup—File

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-2 Computer Setup—File

Option	Description
System Information	Lists: • Product name • SKU number (some models) • Processor type/speed/stepping • Cache size (L1/L2/L3) (dual core processors have this listed twice) • Installed memory size/speed, number of channels (single or dual) (if applicable) • Integrated MAC address for embedded, enabled NIC (if applicable) • System BIOS (includes family name and version) • Chassis serial number • Asset tracking number • ME firmware version • ME Management mode
About	Displays copyright notice.
Set Time and Date	Allows you to set system time and date.
Flash System ROM	Allows you to update the system ROM with a BIOS image file located on removable media.
Replicated Setup	**Save to Removable Media** Saves system configuration, including CMOS, to a formatted USB flash media device. **Restore from Removable Media** Restores system configuration from a USB flash media device.
Default Setup	**Save Current Settings as Default** Saves the current system configuration settings as the default. **Restore Factory Settings as Default** Restores the factory system configuration settings as the default.
Apply Defaults and Exit	Applies the currently selected default settings and clears any established passwords.
Ignore Changes and Exit	Exits Computer Setup without applying or saving any changes.
Save Changes and Exit	Saves changes to system configuration or default settings and exits Computer Setup.

Computer Setup—Storage

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-3 Computer Setup—Storage

Option	Description
Device Configuration	Lists all installed BIOS-controlled storage devices. When a device is selected, detailed information and options are displayed. The following options may be presented: **CD-ROM**: Size, model, firmware version, serial number, connector color (not included for USB CD-ROM). **Hard Disk**: Size, model, firmware version, serial number, connector color. • SMART (ATA disks only) • Translation mode (ATA disks only) • Connector color*(ATA disks only)* Lets you select the translation mode to be used for the device. This enables the BIOS to access disks partitioned and formatted on other systems and may be necessary for users of older versions of UNIX (e.g., SCO UNIX version 3.2). Options are Automatic, Bit-Shift, LBA Assisted, User, and Off. Available only when the drive translation mode is set to User, allows you to specify the parameters (logical cylinders, heads, and sectors per track) used by the BIOS to translate disk I/O requests (from the operating system or an application) into terms the hard drive can accept. Logical cylinders may not exceed 1024. The number of heads may not exceed 256. The number of sectors per track may not exceed 63. **CAUTION:** Ordinarily, the translation mode selected automatically by the BIOS should not be changed. If the selected translation mode is not compatible with the translation mode that was active when the disk was partitioned and formatted, the data on the disk will be inaccessible. **Diskette**: Model and firmware version. **NOTE:** Displays for USB diskette drives. **Default Values** *(ATA disks only)* **SATA Defaults** See Translation Mode above for details.

Table 3-3 Computer Setup—Storage (continued)

Storage Options	**eSATA Port** (some models) Allows you to set a SATA port as an eSATA port for use with an external drive. Default is enabled. This setting affects only the port with the black connector, labeled as eSATA on the system board. This port should have the eSATA back panel connector attached to use eSATA drives. For more information, see the eSATA white paper at www.hp.com. **SATA Emulation** Allows you to choose how the SATA controller and devices are accessed by the operating system. There are three supported options: IDE, RAID, and AHCI (default). IDE - This is the most backwards-compatible setting of the three options. Operating systems usually do not require additional driver support in IDE mode. RAID - Allows DOS and boot access to RAID volumes. Use this mode with the RAID device driver loaded in the operating system to take advantage of RAID features. AHCI (default option) - Allows operating systems with AHCI device drivers loaded to take advantage of more advanced features of the SATA controller. **NOTE:** The RAID/AHCI device driver must be installed prior to attempting to boot from a RAID/AHCI volume. If you attempt to boot from a RAID/AHCI volume without the required device driver installed, the system will crash (blue screen). RAID volumes may become corrupted if they are booted to after disabling RAID. **NOTE:** RAID is not available on USDT systems. **Removable Media Boot** Enables/disables ability to boot the system from removable media. Default is enabled. **Max eSATA Speed** (some models) Allows you to choose 1.5 Gbps or 3.0 Gpbs as the maximum eSATA speed. By default, the speed is limited to 1.5 Gbps for maximum reliability. **CAUTION:** Consult your eSATA drive and cable manufacturer before enabling 3.0 Gpbs speed. Some drive and cable combinations may not run reliably at 3.0 Gpbs. **NOTE:** eSATA is not available on USDT systems.

Table 3-3 Computer Setup—Storage (continued)

DPS Self-Test	Allows you to execute self-tests on ATA hard drives capable of performing the Drive Protection System (DPS) self-tests. **NOTE:** This selection will only appear when at least one drive capable of performing the DPS self-tests is attached to the system.
Boot Order	Allows you to: • Specify the order in which EFI boot sources (such as a internal hard drive, USB hard drive, USB optical drive, or internal optical drive) are checked for a bootable operating system image. Each device on the list may be individually excluded from or included for consideration as a bootable operating system source. EFI boot sources always have precedence over legacy boot sources. • Specify the order in which legacy boot sources (such as a network interface card, internal hard drive, USB optical drive, or internal optical drive) are checked for a bootable operating system image. Each device on the list may be individually excluded from or included for consideration as a bootable operating system source. • Specify the order of attached hard drives. The first hard drive in the order will have priority in the boot sequence and will be recognized as drive C (if any devices are attached). **NOTE:** You can use F5 to disable individual boot items, as well as disable EFI boot and/or legacy boot. **NOTE:** MS-DOS drive lettering assignments may not apply after a non-MS-DOS operating system has started. **Shortcut to Temporarily Override Boot Order** To boot **one time** from a device other than the default device specified in Boot Order, restart the computer and press Esc (to access the boot menu) and then F9 (Boot Order), or only F9 (skipping the boot menu) when the monitor light turns green. After POST is completed, a list of bootable devices is displayed. Use the arrow keys to select the preferred bootable device and press Enter. The computer then boots from the selected non-default device for this one time.

Computer Setup—Security

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-4 Computer Setup—Security

Option	Description
Setup Password	Allows you to set and enable a setup (administrator) password. **NOTE:** If the setup password is set, it is required to change Computer Setup options, flash the ROM, and make changes to certain plug and play settings. **NOTE:** This selection will only appear when at least one drive that supports the DriveLock feature is attached to the system. See the *Desktop Management Guide* for more information.

Table 3-4 Computer Setup—Security (continued)

Power-On Password	Allows you to set and enable a power-on password. The power-on password prompt appears after a power cycle. If the user does not enter the correct power-on password, the unit will not boot. **NOTE:** This selection will only appear when at least one drive that supports the DriveLock feature is attached to the system. See the *Desktop Management Guide* for more information.
Password Options (This selection appears only if a power-on password or setup password is set.)	Allows you to enable/disable: • Lock Legacy Resources (appears if a setup password is set). Default is enabled. • Setup Browse Mode (appears if a setup password is set) (allows viewing, but not changing, the F10 Setup Options without entering setup password). Default is enabled. • Password prompt on F9, F11, & F12 (allows access to menus without entering setup password). Default is enabled. • Network Server Mode (appears if a power-on password is set). Default is disabled. See the *Desktop Management Guide* for more information.
Smart Cover (some models)	Allows you to: • Lock/unlock the Cover Lock. • Set the Cover Removal Sensor to Disable/Notify User/Setup Password. **NOTE:** *Notify User* alerts the user that the sensor has detected that the cover has been removed. *Setup Password* requires that the setup password be entered to boot the computer if the sensor detects that the cover has been removed. This feature is supported on some models only. See the *Desktop Management Guide* for more information.
Device Security	Allows you to set Device Available/Device Hidden (default is Device Available) for: • Embedded security device (some models) • System audio • Serial ports (some models) • Parallel port (some models) • Network controller **NOTE:** You must disable AMT before trying to hide the network controller. • SATA0 • SATA1 • SATA2 (some models) • SATA3 (some models) • SATA4 (some models)

Table 3-4 Computer Setup—Security (continued)

USB Security	Allows you to set Enabled/Disabled (default is Enabled) for: • Front USB Ports ◦ USB Port 1 ◦ USB Port 2 ◦ USB Port 3 ◦ USB Port 4 • Rear USB Ports ◦ USB Port 1 ◦ USB Port 2 ◦ USB Port 3 ◦ USB Port 4 ◦ USB Port 5 ◦ USB Port 6 • Accessory USB Ports ◦ USB Port 1 ◦ USB Port 2 (some models) ◦ USB Port 3 (some models) ◦ USB Port 4 (some models)
Slot Security	Allows you to disable any PCI or PCI Express slot. Default is enabled.
Network Boot	Enables/disables the computer's ability to boot from an operating system installed on a network server. (Feature available on NIC models only; the network controller must be either a PCI expansion card or embedded on the system board.) Default is enabled.
System IDs	Allows you to set: • Asset tag (18-byte identifier), a property identification number assigned by the company to the computer. • Ownership tag (80-byte identifier) displayed during POST. • Chassis serial number or Universal Unique Identifier (UUID) number. The UUID can only be updated if the current chassis serial number is invalid. (These ID numbers are normally set in the factory and are used to uniquely identify the system.) • Keyboard locale setting for System ID entry.

Table 3-4 Computer Setup—Security (continued)

System Security (some models: these options are hardware dependent)	Data Execution Prevention (enable/disable) - Helps prevent operating system security breaches. Default is enabled. Virtualization Technology (VTx)(some models) (enable/disable) - Controls the virtualization features of the processor. Changing this setting requires turning the computer off and then back on. Default is disabled. Virtualization Technology Directed I/O (VTd) (some models) (enable/disable) - Controls virtualization DMA remapping features of the chipset. Changing this setting requires turning the computer off and then back on. Default is disabled. Intel TXT (LT) Support (some models) (enable/disable) - Controls the underlying processor and chipset features needed to support a virtual appliance. Changing this setting requires turning the computer off and then back on. Default is disabled. To enable this feature you must enable the following features: • Embedded Security Device Support • Virtualization Technology • Virtualization Technology Directed I/O Embedded Security Device Support (some models) (enable/disable) - Permits activation and deactivation of the Embedded Security Device. Changing this setting requires turning the computer off and then back on. **NOTE:** To configure the Embedded Security Device, a Setup password must be set. • Reset to Factory Settings (some models) (Do not reset/Reset) - Resetting to factory defaults will erase all security keys. Changing this setting requires turning the computer off and then back on. Default is Do not reset. **CAUTION:** The embedded security device is a critical component of many security schemes. Erasing the security keys will prevent access to data protected by the Embedded Security Device. Choosing Reset to Factory Settings may result in significant data loss. OS management of Embedded Security Device (some models) (enable/disable) - This option allows the user to limit operating system control of the Embedded Security Device. Changing this setting requires turning the computer off and then back on. This option allows the user to limit OS control of the Embedded Security Device. Default is enabled. Reset of Embedded Security Device through OS (some models) (enable/disable) - This option allows the user to limit the operating system ability to request a Reset to Factory Settings of the Embedded Security Device. Changing this setting requires turning the computer off and then back on. Default is disabled. **NOTE:** To enable this option, a Setup password must be set.
DriveLock Security	Allows you to assign or modify a master or user password for hard drives. When this feature is enabled, the user is prompted to provide one of the DriveLock passwords during POST. If neither is successfully entered, the hard drive will remain inaccessible until one of the passwords is successfully provided during a subsequent cold-boot sequence. **NOTE:** This selection will only appear when at least one drive that supports the DriveLock feature is attached to the system. See the *Desktop Management Guide* for more information.

Computer Setup—Power

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-5 Computer Setup—Power

Option	Description
OS Power Management	• Runtime Power Management— Enable/Disable. Allows certain operating systems to reduce processor voltage and frequency when the current software load does not require the full capabilities of the processor. Default is enabled. • Idle Power Savings—Extended/Normal. Allows certain operating systems to decrease the processors power consumption when the processor is idle. Default is extended. • Unique Sleep State Blink Rates—Enable/Disable. This feature is designed to provide a visual indication of what sleep state the system is in. Each sleep state has a unique blink pattern. Default is disabled. ◦ S0 (On) = Solid green LED. ◦ S3 (Stand By)= 3 blinks at 1Hz (50% duty cycle) followed by a pause of 2 seconds (green LED) — repeated cycles of 3 blinks and a pause. ◦ S4 (Hibernation)= 4 blinks at 1Hz (50% duty cycle) followed by a pause of 2 seconds (green LED) — repeated cycles of 4 blinks and a pause. ◦ S5 (Soft Off) = LED is off. **NOTE:** If this feature is disabled, S4 and S5 both have the LED off. S1 (no longer supported) and S3 use 1 blink per second.
Hardware Power Management	SATA Power Management – Enables or disables SATA bus and/or device power management. Default is enabled. S5 Maximum Power Savings—Turns off power to all nonessential hardware when system is off to meet EUP Lot 6 requirement of less than 1 Watt power usage. Default is disabled.
Thermal	Fan idle mode—This bar graph controls the minimum permitted fan speed. **NOTE:** This setting only changes the minimum fan speed. The fans are still automatically controlled.

Computer Setup—Advanced

NOTE: Support for specific Computer Setup options may vary depending on the hardware configuration.

Table 3-6 Computer Setup—Advanced (for advanced users)

Option	Heading
Power-On Options	Allows you to set: • POST mode (QuickBoot, Clear Memory, FullBoot, or FullBoot Every x Days). ◦ QuickBoot (default) = Do not clear memory or perform a memory test. ◦ FullBoot = Memory test (count) on cold boot. Clears memory on all boots. ◦ Clear Memory = No memory count on cold boot. Clears memory on all boots. ◦ FullBoot Every x Days = Memory count on 1st cold boot on or after the xth day. No more memory counts until 1st cold boot on or after x days. Clears memory on all boots. • POST messages (enable/disable). Default is disabled. • Press the ESC key for Startup Menu (Enable/Disable). Default is enabled. • Option ROM Prompt (enable/disable). Enabling this feature will cause the system to display a message before loading option ROMs. Default is enabled. • After Power Loss (off/on/previous state). Default is Power off. Setting this option to: ◦ Power off—causes the computer to remain powered off when power is restored. ◦ Power on—causes the computer to power on automatically as soon as power is restored. ◦ Previous state—causes the computer to power on automatically as soon as power is restored, if it was on when power was lost. **NOTE:** If you turn off power to the computer using the switch on a power strip, you will not be able to use the suspend/sleep feature or the Remote Management features. • POST Delay (in seconds). Enabling this feature will add a user-specified delay to the POST process. This delay is sometimes needed for hard disks on some PCI cards that spin up very slowly, so slowly that they are not ready to boot by the time POST is finished. The POST delay also gives you more time to select F10 to enter Computer (F10) Setup. Default is None. • Remote Wakeup Boot Source (remote server/local hard drive). Default is Local hard drive. • System Recovery Boot Support (Enable/Disable). Provides the ability for the BIOS to redirect the boot to the recovery partition on the user hard drive, if present. Some versions of the recovery software honor the F11 key press even when this feature is disabled by the BIOS. Default is disabled. • Bypass F1 Prompt on Configuration Changes (Enable/Disable). Allows you to set the computer not to confirm when changes were made. Default is disabled.
BIOS Power-On	Allows you to set the computer to turn on automatically at a time you specify.
Onboard Devices	Allows you to set resources for or disable Legacy devices.

Table 3-6 Computer Setup—Advanced (for advanced users) (continued)

Bus Options	On some models, allows you to enable or disable: • PCI SERR# Generation. Default is enabled. • PCI VGA Palette Snooping, which sets the VGA palette snooping bit in PCI configuration space; only needed when more than one graphics controller is installed. Default is disabled.
Device Options	Allows you to set: • Turbo Mode (enable/disable). Allows you to enable and disable the Intel Turbo Mode feature, which allows one core of the system to run at a higher than standard frequency and power if other cores are idle. Default is enabled. • Printer mode (Bi-Directional, EPP + ECP, Output Only). Default is EPP+ECP. • Num Lock State at Power-On (off/on). Default is off. • Integrated Video (enable/disable). Use this option to disable the integrated video controller when another video controller is present in the system. Default is enabled. • Internal Speaker (some models) (does not affect external speakers). Default is enabled. • NIC Option ROM Download (PXE, iSCSI, disabled). The BIOS contains an embedded NIC option ROM to allow the unit to boot through the network to a PXE server. This is typically used to download a corporate image to a hard drive. The NIC option ROM takes up memory space below 1MB commonly referred to as DOS Compatibility Hole (DCH) space. This space is limited. This F10 option will allow users to disable the downloading of this embedded NIC option ROM thus giving more DCH space for additional PCI cards which may need option ROM space. The default will be to have the NIC option-ROM-enabled. Default is PXE. • Multi-Processor (enable/disable). Use this option to disable multi-processor support under the OS. Default is enabled. • Hyper-threading (enable/disable) (some models). Use this option to disable processor hyper-threading.
VGA Configuration	Displayed only if there is an add-in video card in the system. Allows you to specify which VGA controller will be the “boot” or primary VGA controller.
AMT Configuration	Allows you to set: • AMT (enable/disable). Allows you to enable or disable functions of the embedded Management Engine (ME) such as Active Management Technology (AMT). If set to disable, the Management Engine is set to a temporarily disabled state and will not provide functions beyond necessary system configuration. Default is enabled. • Unconfigure AMT/ME (enable/disable). Allows you to unconfigure any provisioned management settings for AMT. The AMT settings are restored to factory defaults. This feature should be used with caution as AMT will not be able to provide any set AMT management functions once unconfigured. Default is disabled. • Watchdog Timer (enable/disable). Allows you to set amount of time for a operating system and BIOS watchdog alert to be sent if the timers are not deactivated. BIOS watchdog is deactivated by BIOS and would indicate that a halt occurred during execution if the alert is sent to the management console. An operating system alert is deactivated by the operating system image and would indicate that a hang occurred during its initialization. Default is enabled.

Recovering the Configuration Settings

This method of recovery requires that you first perform the **Save to Removable Media** command with the Computer Setup (F10) Utility before **Restore** is needed. (See Save to Removable Media on page 18 in the Computer Setup—File table.)

NOTE: It is recommended that you save any modified computer configuration settings to a USB flash media device and save the device for possible future use.

To restore the configuration, insert the USB flash media device with the saved configuration and perform the **Restore from Removable Media** command with the Computer Setup (F10) Utility. (See Restore from Removable Media on page 18 in the Computer Setup—File table.)

4 Routine Care, SATA Drive Guidelines, and Disassembly Preparation

This chapter provides general service information for the computer. Adherence to the procedures and precautions described in this chapter is essential for proper service.

⚠ **CAUTION:** When the computer is plugged into an AC power source, voltage is always applied to the system board. You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

Electrostatic Discharge Information

A sudden discharge of static electricity from your finger or other conductor can destroy static-sensitive devices or microcircuitry. Often the spark is neither felt nor heard, but damage occurs. An electronic device exposed to electrostatic discharge (ESD) may not appear to be affected at all and can work perfectly throughout a normal cycle. The device may function normally for a while, but it has been degraded in the internal layers, reducing its life expectancy.

Networks built into many integrated circuits provide some protection, but in many cases, the discharge contains enough power to alter device parameters or melt silicon junctions.

Generating Static

The following table shows that:

- Different activities generate different amounts of static electricity.
- Static electricity increases as humidity decreases.

	Relative Humidity		
Event	**55%**	**40%**	**10%**
Walking across carpet	7,500 V	15,000 V	35,000 V
Walking across vinyl floor	3,000 V	5,000 V	12,000 V
Motions of bench worker	400 V	800 V	6,000 V
Removing DIPs from plastic tube	400 V	700 V	2,000 V

Removing DIPs from vinyl tray	2,000 V	4,000 V	11,500 V
Removing DIPs from Styrofoam	3,500 V	5,000 V	14,500 V
Removing bubble pack from PCB	7,000 V	20,000 V	26,500 V
Packing PCBs in foam-lined box	5,000 V	11,000 V	21,000 V
These are then multi-packaged inside plastic tubes, trays, or Styrofoam.			

NOTE: 700 volts can degrade a product.

Preventing Electrostatic Damage to Equipment

Many electronic components are sensitive to ESD. Circuitry design and structure determine the degree of sensitivity. The following packaging and grounding precautions are necessary to prevent damage to electric components and accessories.

- To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.
- Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.
- Keep electrostatic sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from their container.
- Always be properly grounded when touching a sensitive component or assembly.
- Avoid contact with pins, leads, or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

Personal Grounding Methods and Equipment

Use the following equipment to prevent static electricity damage to equipment:

- **Wrist straps** are flexible straps with a maximum of one-megohm ± 10% resistance in the ground cords. To provide proper ground, a strap must be worn snug against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or workstation.
- **Heel straps/Toe straps/Boot straps** can be used at standing workstations and are compatible with most types of shoes or boots. On conductive floors or dissipative floor mats, use them on both feet with a maximum of one-megohm ± 10% resistance between the operator and ground.

Static Shielding Protection Levels	
Method	**Voltage**
Antistatic plastic	1,500
Carbon-loaded plastic	7,500
Metallized laminate	15,000

Grounding the Work Area

To prevent static damage at the work area, use the following precautions:

- Cover the work surface with approved static-dissipative material. Provide a wrist strap connected to the work surface and properly grounded tools and equipment.
- Use static-dissipative mats, foot straps, or air ionizers to give added protection.
- Handle electrostatic sensitive components, parts, and assemblies by the case or PCB laminate. Handle them only at static-free work areas.
- Turn off power and input signals before inserting and removing connectors or test equipment.
- Use fixtures made of static-safe materials when fixtures must directly contact dissipative surfaces.
- Keep work area free of nonconductive materials such as ordinary plastic assembly aids and Styrofoam.
- Use field service tools, such as cutters, screwdrivers, and vacuums, that are conductive.

Recommended Materials and Equipment

Materials and equipment that are recommended for use in preventing static electricity include:

- Antistatic tape
- Antistatic smocks, aprons, or sleeve protectors
- Conductive bins and other assembly or soldering aids
- Conductive foam
- Conductive tabletop workstations with ground cord of one-megohm +/- 10% resistance
- Static-dissipative table or floor mats with hard tie to ground
- Field service kits
- Static awareness labels
- Wrist straps and footwear straps providing one-megohm +/- 10% resistance
- Material handling packages
- Conductive plastic bags
- Conductive plastic tubes
- Conductive tote boxes
- Opaque shielding bags
- Transparent metallized shielding bags
- Transparent shielding tubes

Operating Guidelines

To prevent overheating and to help prolong the life of the computer:

- Keep the computer away from excessive moisture, direct sunlight, and extremes of heat and cold.
- Operate the computer on a sturdy, level surface. Leave a 10.2-cm (4-inch) clearance on all vented sides of the computer and above the monitor to permit the required airflow.
- Never restrict the airflow into the computer by blocking any vents or air intakes. Do not place the keyboard, with the keyboard feet down, directly against the front of the desktop unit as this also restricts airflow.
- Occasionally clean the air vents on all vented sides of the computer. Lint, dust, and other foreign matter can block the vents and limit the airflow. Be sure to unplug the computer before cleaning the air vents.
- Never operate the computer with the cover or side panel removed.
- Do not stack computers on top of each other or place computers so near each other that they are subject to each other's re-circulated or preheated air.
- If the computer is to be operated within a separate enclosure, intake and exhaust ventilation must be provided on the enclosure, and the same operating guidelines listed above will still apply.
- Keep liquids away from the computer and keyboard.
- Never cover the ventilation slots on the monitor with any type of material.
- Install or enable power management functions of the operating system or other software, including sleep states.

Routine Care

General Cleaning Safety Precautions

1. Never use solvents or flammable solutions to clean the computer.
2. Never immerse any parts in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.
3. Always unplug the computer when cleaning with liquids or damp cloths.
4. Always unplug the computer before cleaning the keyboard, mouse, or air vents.
5. Disconnect the keyboard before cleaning it.
6. Wear safety glasses equipped with side shields when cleaning the keyboard.

Cleaning the Computer Case

Follow all safety precautions in General Cleaning Safety Precautions on page 32 before cleaning the computer.

To clean the computer case, follow the procedures described below:

- To remove light stains or dirt, use plain water with a clean, lint-free cloth or swab.
- For stronger stains, use a mild dishwashing liquid diluted with water. Rinse well by wiping it with a cloth or swab dampened with clear water.
- For stubborn stains, use isopropyl (rubbing) alcohol. No rinsing is needed as the alcohol will evaporate quickly and not leave a residue.
- After cleaning, always wipe the unit with a clean, lint-free cloth.
- Occasionally clean the air vents on the computer. Lint and other foreign matter can block the vents and limit the airflow.

Cleaning the Keyboard

Follow all safety precautions in General Cleaning Safety Precautions on page 32 before cleaning the keyboard.

To clean the tops of the keys or the keyboard body, follow the procedures described in Cleaning the Computer Case on page 32.

When cleaning debris from under the keys, review all rules in General Cleaning Safety Precautions on page 32 before following these procedures:

⚠ **CAUTION:** Use safety glasses equipped with side shields before attempting to clean debris from under the keys.

- Visible debris underneath or between the keys may be removed by vacuuming or shaking.
- Canned, pressurized air may be used to clean debris from under the keys. Caution should be used as too much air pressure can dislodge lubricants applied under the wide keys.
- If you remove a key, use a specially designed key puller to prevent damage to the keys. This tool is available through many electronic supply outlets.

  ⚠ **CAUTION:** Never remove a wide leveled key (like the space bar) from the keyboard. If these keys are improperly removed or installed, the keyboard may not function properly.

- Cleaning under a key may be done with a swab moistened with isopropyl alcohol and squeezed out. Be careful not to wipe away lubricants necessary for proper key functions. Use tweezers to remove any fibers or dirt in confined areas. Allow the parts to air dry before reassembly.

Cleaning the Monitor

- Wipe the monitor screen with a clean cloth moistened with water or with a towelette designed for cleaning monitors. Do not use sprays or aerosols directly on the screen; the liquid may seep into the housing and damage a component. Never use solvents or flammable liquids on the monitor.
- To clean the monitor body follow the procedures in Cleaning the Computer Case on page 32.

Cleaning the Mouse

Before cleaning the mouse, ensure that the power to the computer is turned off.

- Clean the mouse ball by first removing the retaining plate and the ball from the housing. Pull out any debris from the ball socket and wipe the ball with a clean, dry cloth before reassembly.
- To clean the mouse body, follow the procedures in Cleaning the Computer Case on page 32.

Service Considerations

Listed below are some of the considerations that you should keep in mind during the disassembly and assembly of the computer.

Power Supply Fan

The power supply fan is a variable-speed fan based on the temperature in the power supply.

⚠ **CAUTION:** The cooling fan is always on when the computer is in the “On” mode. The cooling fan is off when the computer is in “Standby,” “Suspend,” or “Off” modes.

You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

Tools and Software Requirements

To service the computer, you need the following:

- Torx T-15 screwdriver (HP screwdriver with bits, PN 161946-001)
- Torx T-15 screwdriver with small diameter shank (for certain front bezel removal)
- Flat-bladed screwdriver (may sometimes be used in place of the Torx screwdriver)
- Phillips #2 screwdriver
- Diagnostics software
- HP tamper-resistant T-15 wrench (Smart Cover FailSafe Key, PN 166527-001) or HP tamper-resistant bits (Smart Cover FailSafe Key, PN 166527-002)

Screws

The screws used in the computer are not interchangeable. They may have standard or metric threads and may be of different lengths. If an incorrect screw is used during the reassembly process, it can damage the unit. HP strongly recommends that all screws removed during disassembly be kept with the part that was removed, then returned to their proper locations.

⚠ **CAUTION:** Metric screws have a black finish. U.S. screws have a silver finish and are used on hard drives only.

CAUTION: As each subassembly is removed from the computer, it should be placed away from the work area to prevent damage.

Cables and Connectors

Most cables used throughout the unit are flat, flexible cables. These cables must be handled with care to avoid damage. Apply only the tension required to seat or unseat the cables during insertion or removal from the connector. Handle cables by the connector whenever possible. In all cases, avoid bending or twisting the cables, and ensure that the cables are routed in such a way that they cannot be caught or snagged by parts being removed or replaced.

⚠ **CAUTION:** When servicing this computer, ensure that cables are placed in their proper location during the reassembly process. Improper cable placement can damage the computer.

Hard Drives

Handle hard drives as delicate, precision components, avoiding all physical shock and vibration. This applies to failed drives as well as replacement spares.

- If a drive must be mailed, place the drive in a bubble-pack mailer or other suitable protective packaging and label the package “Fragile: Handle With Care.”
- Do not remove hard drives from the shipping package for storage. Keep hard drives in their protective packaging until they are actually mounted in the CPU.
- Avoid dropping drives from any height onto any surface.
- If you are inserting or removing a hard drive, turn off the computer. Do not remove a hard drive while the computer is on or in standby mode.
- Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Electrostatic Discharge Information on page 29
- Do not use excessive force when inserting a drive.
- Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

Lithium Coin Cell Battery

The battery that comes with the computer provides power to the real-time clock and has a minimum lifetime of about three years.

See the appropriate removal and replacement chapter for the chassis you are working on in this guide for instructions on the replacement procedures.

⚠ **WARNING!** This computer contains a lithium battery. There is a risk of fire and chemical burn if the battery is handled improperly. Do not disassemble, crush, puncture, short external contacts, dispose in water or fire, or expose it to temperatures higher than 140ºF (60ºC). Do not attempt to recharge the battery.

NOTE: Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to HP, their authorized partners, or their agents.

SATA Hard Drives

Serial ATA Hard Drive Characteristics	
Number of pins/conductors in data cable	7/7
Number of pins in power cable	15
Maximum data cable length	39.37 in (100 cm)
Data interface voltage differential	400-700 mV
Drive voltages	3.3 V, 5 V, 12 V
Jumpers for configuring drive	N/A
Data transfer rate	3.0 Gb/s

SATA Hard Drive Cables

SATA Data Cable

Always use an HP approved SATA 3.0 Gb/s cable as it is fully backwards compatible with the SATA 1.5 Gb/s drives.

Current HP desktop products ship with SATA 3.0 Gb/s hard drives.

SATA data cables are susceptible to damage if overflexed. Never crease a SATA data cable and never bend it tighter than a 30 mm (1.18 in) radius.

The SATA data cable is a thin, 7-pin cable designed to transmit data for only a single drive.

SMART ATA Drives

The Self Monitoring Analysis and Recording Technology (SMART) ATA drives for the HP Personal Computers have built-in drive failure prediction that warns the user or network administrator of an impending failure or crash of the hard drive. The SMART drive tracks fault prediction and failure indication parameters such as reallocated sector count, spin retry count, and calibration retry count. If the drive determines that a failure is imminent, it generates a fault alert.

Cable Management

Always follow good cable management practices when working inside the computer.

- Keep cables away from major heat sources like the heat sink.
- Do not jam cables on top of expansion cards or memory modules. Printed circuit cards like these are not designed to take excessive pressure on them.
- Keep cables clear of sliding or moveable parts to prevent them from being cut or crimped when the parts are moved.
- When folding a flat ribbon cable, never fold to a sharp crease. Sharp creases may damage the wires.

- Some flat ribbon cables come prefolded. Never change the folds on these cables.
- Do not bend any cable sharply. A sharp bend can break the internal wires.
- Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.
- Never crease a SATA data cable.
- Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves.

5 Removal and Replacement Procedures

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

NOTE: Not all features listed in this guide are available on all computers.

Preparation for Disassembly

See Routine Care, SATA Drive Guidelines, and Disassembly Preparation on page 29 for initial safety procedures.

1. Remove/disengage any security devices that prohibit opening the computer.
2. Close any open software applications.
3. Exit the operating system.
4. Remove any compact disc or media card from the computer.
5. Turn off the computer and any peripheral devices that are connected to it.

   CAUTION: Turn off the computer before disconnecting any cables.

   Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. The power cord should always be disconnected before servicing a unit.
6. Disconnect the power cord from the electrical outlet and then from the computer.
7. Disconnect all peripheral device cables from the computer.

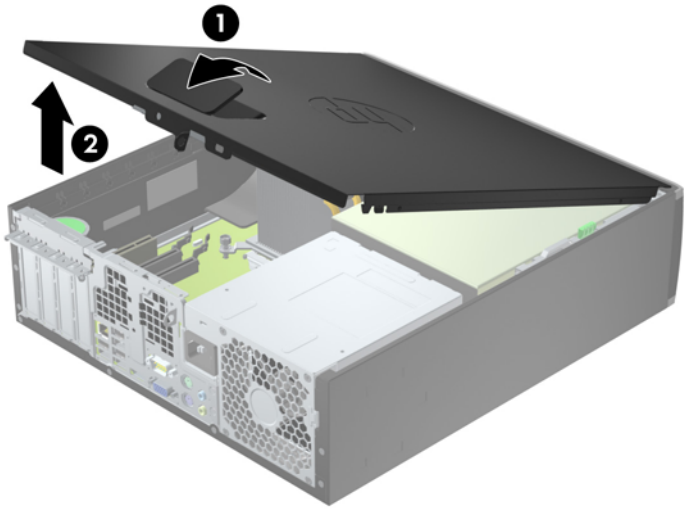
NOTE: During disassembly, label each cable as you remove it, noting its position and routing. Keep all screws with the units removed.

CAUTION: The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

Access Panel

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. If the computer is on a stand, remove the computer from the stand.
3. Lift up on the access panel handle **(1)** then lift the access panel off the computer **(2)**.

Figure 5-1 Removing the access panel

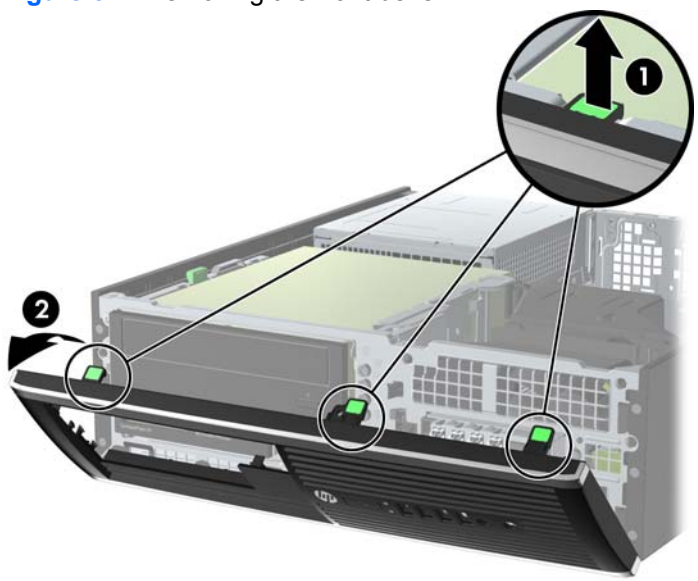


To install the access panel, reverse the removal procedure.

Front Bezel

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Lift up the three tabs on the side of the bezel **(1)**, then rotate the bezel off the chassis **(2)**.

Figure 5-2 Removing the front bezel



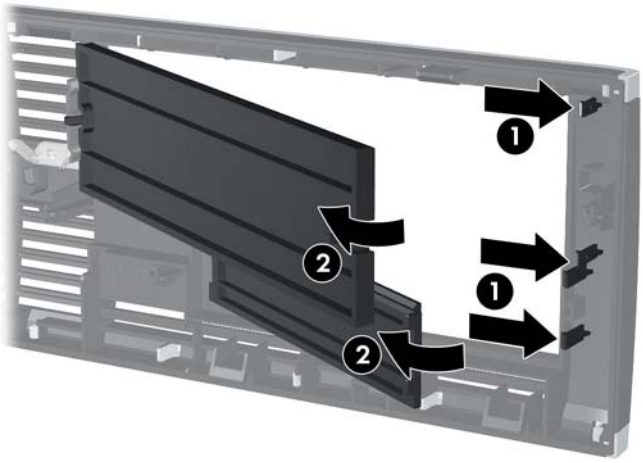
To install the front bezel, reverse the removal procedure.

Bezel Blanks

On some models, there are bezel blanks covering the 3.5-inch and 5.25-inch external drive bays that need to be removed before installing a drive. To remove a bezel blank:

1. Remove the access panel (Access Panel on page 39).
2. Remove the front bezel (Front Bezel on page 40)..
3. To remove a bezel blank, push the two retaining tabs that hold the bezel blank in place towards the outer right edge of the bezel **(1)** and slide the bezel blank back and to the right to remove it **(2)**.

Figure 5-3 Removing a bezel blank



4. Replace the front bezel.

Memory

The computer comes with double data rate 3 synchronous dynamic random access memory (DDR3-SDRAM) dual inline memory modules (DIMMs).

DIMMs

The memory sockets on the system board can be populated with up to four industry-standard DIMMs. These memory sockets are populated with at least one preinstalled DIMM. To achieve the maximum memory support, you can populate the system board with up to 16-GB of memory configured in a high-performing dual channel mode.

DDR3-SDRAM DIMMs

⚠ **CAUTION:** This product DOES NOT support DDR3 Ultra Low Voltage (DDR3U) memory. The processor is not compatible with DDR3U memory and if you plug DDR3U memory into the system board, it can cause the physical damage to the DIMM or invoke system malfunction.

For proper system operation, the DDR3-SDRAM DIMMs must be:

- industry-standard 240-pin
- unbuffered non-ECC PC3-8500 DDR3-1066 MHz-compliant or PC3-10600 DDR3-1333 MHz-compliant
- 1.5 volt DDR3-SDRAM DIMMs

The DDR3-SDRAM DIMMs must also:

- support CAS latency 7 DDR3 1066 MHz (7-7-7 timing) and CAS latency 9 DDR3 1333 MHz (9-9-9 timing)
- contain the mandatory JEDEC SPD information

In addition, the computer supports:

- 512-Mbit, 1-Gbit, and 2-Gbit non-ECC memory technologies
- single-sided and double-sided DIMMs
- DIMMs constructed with x8 and x16 DDR devices; DIMMs constructed with x4 SDRAM are not supported

NOTE: The system will not operate properly if you install unsupported DIMMs.

Populating DIMM Sockets

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled DIMM1, DIMM2, DIMM3, and DIMM4. Sockets DIMM1 and DIMM2 operate in memory channel B. Sockets DIMM3 and DIMM4 operate in memory channel A.

The system will automatically operate in single channel mode, dual channel mode, or flex mode, depending on how the DIMMs are installed.

- The system will operate in single channel mode if the DIMM sockets are populated in one channel only.
- The system will operate in a higher-performing dual channel mode if the total memory capacity of the DIMMs in Channel A is equal to the total memory capacity of the DIMMs in Channel B. The technology and device width can vary between the channels. For example, if Channel A is populated with two 1-GB DIMMs and Channel B is populated with one 2-GB DIMM, the system will operate in dual channel mode.
- The system will operate in flex mode if the total memory capacity of the DIMMs in Channel A is not equal to the total memory capacity of the DIMMs in Channel B. In flex mode, the channel populated with the least amount of memory describes the total amount of memory assigned to dual channel and the remainder is assigned to single channel. For optimal speed, the channels should be balanced so that the largest amount of memory is spread between the two channels. If one channel will have more memory than the other, the larger amount should be assigned to Channel A. For example, if you are populating the sockets with one 2-GB DIMM, and three 1-GB DIMMs, Channel A should be populated with the 2-GB DIMM and one 1-GB DIMM, and Channel B should be populated with the other two 1-GB DIMMs. With this configuration, 4-GB will run as dual channel and 1-GB will run as single channel.
- In any mode, the maximum operational speed is determined by the slowest DIMM in the system.

Installing DIMMs

CAUTION: You must disconnect the power cord and wait approximately 30 seconds for the power to drain before adding or removing memory modules. Regardless of the power-on state, voltage is always supplied to the memory modules as long as the computer is plugged into an active AC outlet. Adding or removing memory modules while voltage is present may cause irreparable damage to the memory modules or system board.

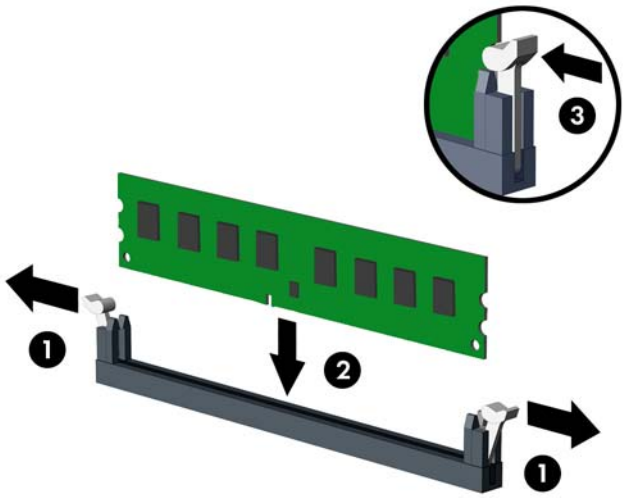
The memory module sockets have gold-plated metal contacts. When upgrading the memory, it is important to use memory modules with gold-plated metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. For more information, refer to Electrostatic Discharge Information on page 29.

When handling a memory module, be careful not to touch any of the contacts. Doing so may damage the module.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Rotate up the internal drive bay housing to access the memory module sockets on the system board.
4. Open both latches of the memory module socket **(1)**, and insert the memory module into the socket **(2)**.

Figure 5-4 Installing a DIMM



NOTE: A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

Populate the black DIMM sockets before the white DIMM sockets.

For maximum performance, populate the sockets so that the memory capacity is spread as equally as possible between Channel A and Channel B. Refer to Populating DIMM Sockets on page 42 for more information.

5. Push the module down into the socket, ensuring that the module is fully inserted and properly seated. Make sure the latches are in the closed position **(3)**.
6. Repeat steps 4 and 5 to install any additional modules.
7. Replace the access panel.
8. If the computer was on a stand, replace the stand.
9. Reconnect the power cord and turn on the computer.
10. Lock any security devices that were disengaged when the access panel was removed.

The computer should automatically recognize the additional memory the next time you turn on the computer.

Expansion Card

The computer has one PCI expansion slot, two PCI Express x1 expansion slots, and one PCI Express x16 expansion slot.

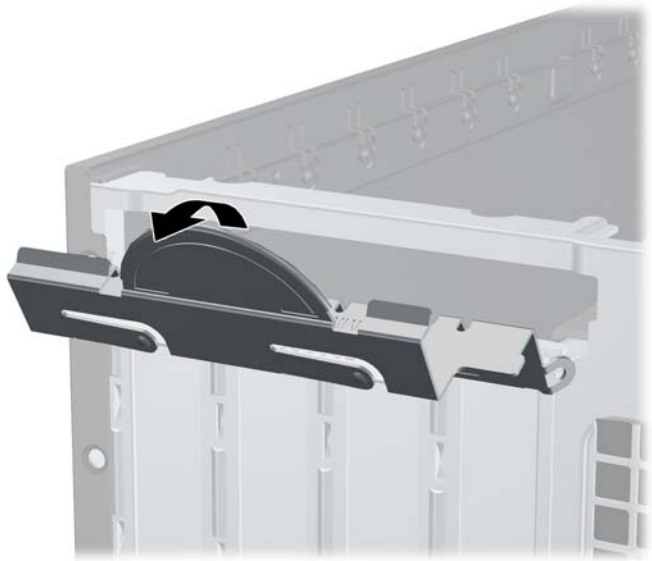
NOTE: The PCI and PCI Express slots support only low profile cards.

You can install a PCI Express x1, x4, x8, or x16 expansion card in the PCI Express x16 slot.

To remove, replace, or add an expansion card:

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.
4. Release the slot cover retention latch that secures the PCI slot covers by lifting the green tab on the latch and rotating the latch to the open position.

Figure 5-5 Opening the expansion slot retainer

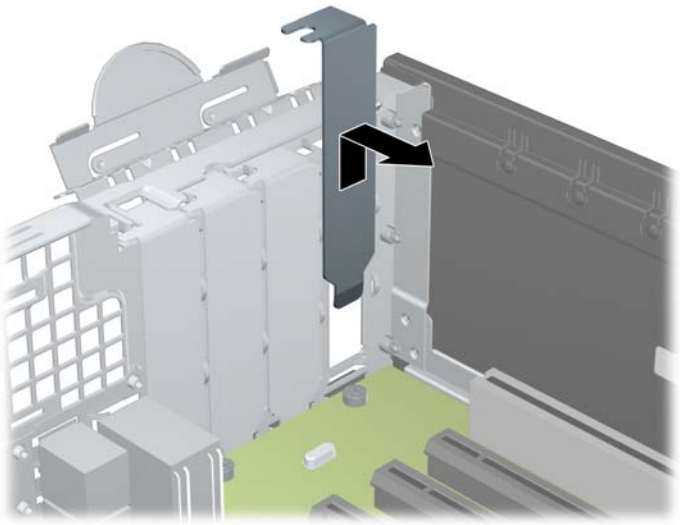


5. Before installing an expansion card, remove the expansion slot cover or the existing expansion card.

NOTE: Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.

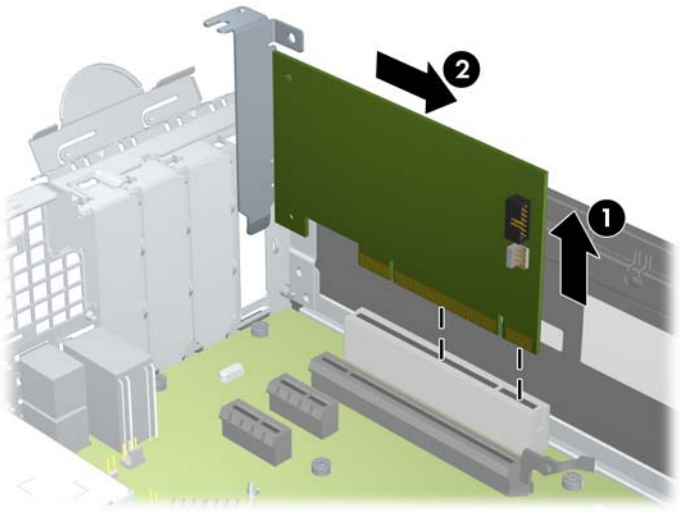
a. If you are installing an expansion card in a vacant socket, remove the appropriate expansion slot cover on the back of the chassis. Pull the slot cover straight up then away from the inside of the chassis.

Figure 5-6 Removing an expansion slot cover



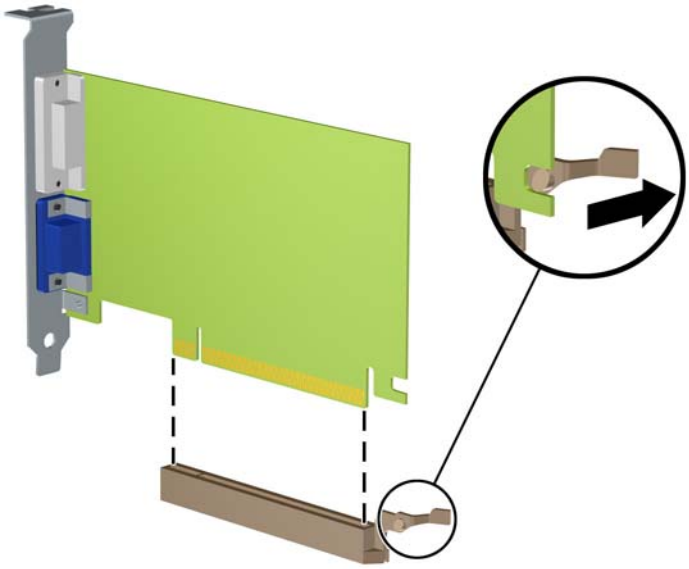
b. If you are removing a standard PCI card or PCI Express x1 card, hold the card at each end, and carefully rock it back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket **(1)** then away from the inside of the chassis to release it from the chassis frame **(2)**. Be sure not to scrape the card against the other components.

Figure 5-7 Removing a standard PCI expansion card



c. If you are removing a PCI Express x16 card, pull the retention arm on the back of the expansion socket away from the card and carefully rock the card back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket then away from the inside of the chassis to release it from the chassis frame. Be sure not to scrape the card against the other components.

Figure 5-8 Removing a PCI Express x16 expansion card

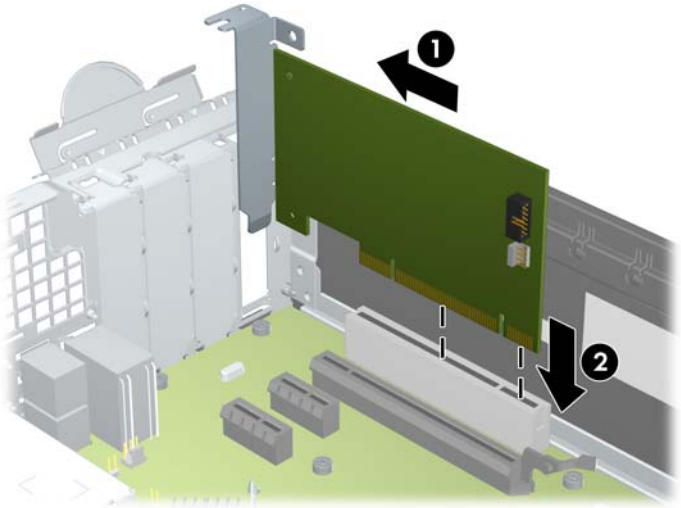


6. Store the removed card in anti-static packaging.
7. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.

⚠ **CAUTION:** After removing an expansion card, you must replace it with a new card or expansion slot cover for proper cooling of internal components during operation.

8. To install a new expansion card, hold the card just above the expansion socket on the system board then move the card toward the rear of the chassis **(1)** so that the bracket on the card is aligned with the open slot on the rear of the chassis. Press the card straight down into the expansion socket on the system board **(2)**.

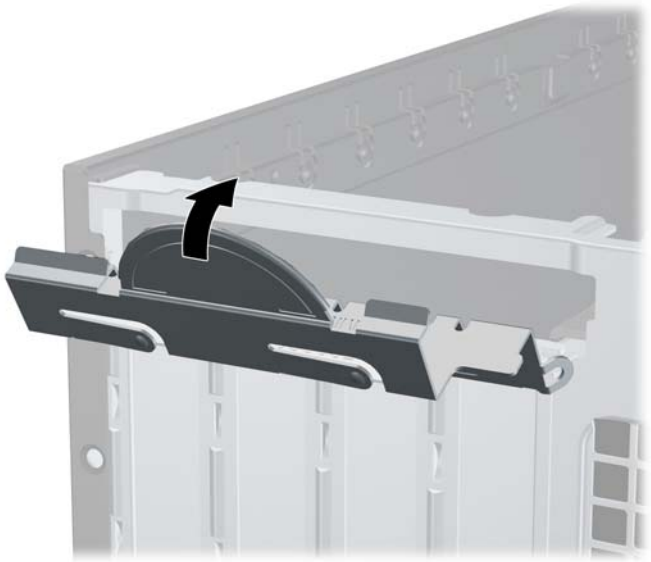
Figure 5-9 Installing an expansion card



NOTE: When installing an expansion card, press firmly on the card so that the whole connector seats properly in the expansion card slot.

9. Rotate the slot cover retention latch back in place to secure the expansion card.

Figure 5-10 Closing the expansion slot retainer



10. Connect external cables to the installed card, if needed. Connect internal cables to the system board, if needed.
11. Replace the computer access panel.
12. If the computer was on a stand, replace the stand.
13. Reconnect the power cord and turn on the computer.

14. Lock any security devices that were disengaged when the access panel was removed.
15. Reconfigure the computer, if necessary.

System Board Connections

Refer to the following illustration and table to identify the system board connectors for your model.

Figure 5-11 System board connections

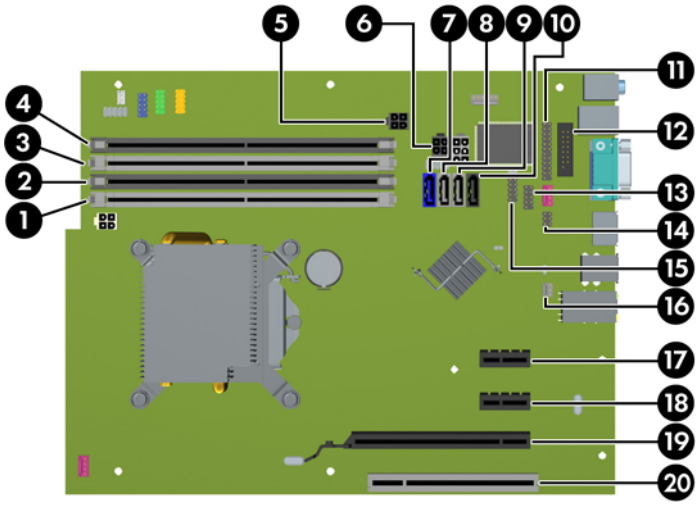


Table 5-1 System board connections

No.	System Board Connector	System Board Label	Color	Component
1	DIMM4 (Channel A)	DIMM4	white	Memory Module
2	DIMM3 (Channel A)	DIMM3	black	Memory Module
3	DIMM2 (Channel B)	DIMM2	white	Memory Module
4	DIMM1 (Channel B)	DIMM1	black	Memory Module
5	Power	SATAPWR0	black	SATA Optical Drives
6	Power	SATAPWR1		SATA Hard Drives
7	SATA 3.0	SATA0	dark blue	1st Hard Drive
8	SATA 2.0	SATA1	white	2nd Hard Drive, or 2nd Optical Drive if an eSATA Adapter Cable exists
9	SATA 2.0	SATA2	white	1st Optical Drive
10	eSATA	ESATA	black	eSATA Adapter Cable, or 2nd Optical Drive
11	Parallel Port	PAR	black	Parallel Port
12	Serial Port	COMB	black	Serial Port
13	USB	MEDIA	black	USB Device, such as a Media Card Reader
14	Hood Lock	HLCK	black	Hood Lock

Table 5-1 System board connections (continued)

No.	System Board Connector	System Board Label	Color	Component
15	USB	MEDIA2	black	USB Device, such as a Media Card Reader
16	Hood Sensor	HSENSE	white	Hood Sensor
17	PCI Express x1	X1PCIEXP1	black	Expansion Card
18	PCI Express x1	X4PCIEXP	black	Expansion Card
19	PCI Express x16	X16PCIEXP	black	Expansion Card
20	PCI	PCI	white	Expansion Card

Drives

Drive Positions

Figure 5-12 Drive positions

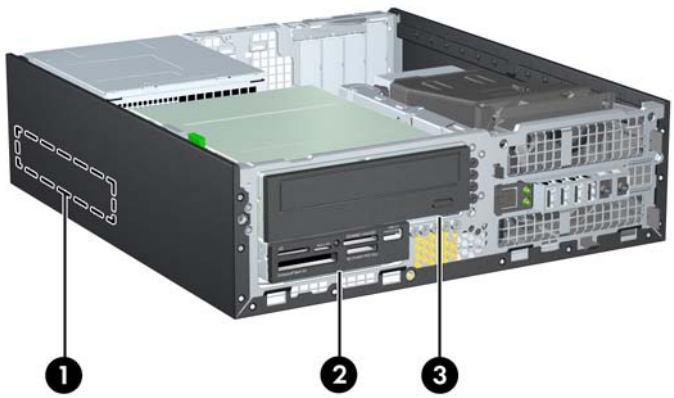


Table 5-2 Drive Positions

1	3.5-inch internal hard drive bay
2	3.5-inch drive bay for optional drives (media card reader shown)
3	5.25-inch drive bay for optional drives (optical drive shown)

NOTE: The drive configuration on your computer may be different than the drive configuration shown above.

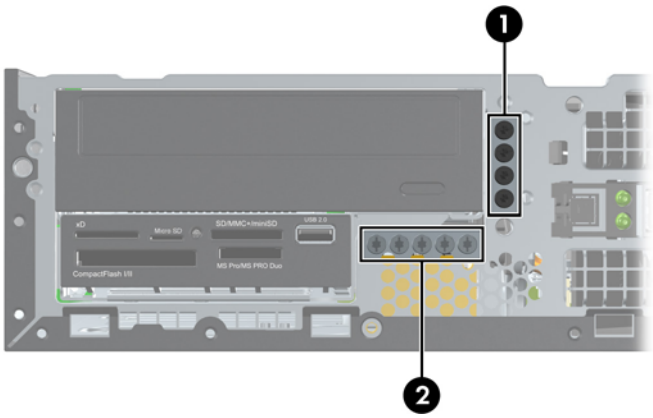
To verify the type and size of the storage devices installed in the computer, run Computer Setup.

Installing and Removing Drives

When installing drives, follow these guidelines:

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA0. If you are adding a second hard drive, connect it to the white connector on the system board labeled SATA1.
- Connect a SATA optical drive to the white SATA connector on the system board labeled SATA2.
- Connect an optional eSATA adapter cable to the black SATA connector on the system board labeled ESATA.
- Connect a media card reader USB cable to the USB connector on the system board labeled MEDIA.
- The power cable for the SATA drives is a three-headed cable that is plugged into the system board with the first connector routed to the rear of the hard drive, the second connector routed to the rear of the 3.5” drive, and the third connector routed to the rear of the 5.25” optical drive.
- The system does not support Parallel ATA (PATA) optical drives or PATA hard drives.
- You must install guide screws to ensure the drive will line up correctly in the drive cage and lock in place. HP has provided extra guide screws for the drive bays (five 6-32 standard screws and four M3 metric screws), installed in the front of the chassis, under the front bezel. The 6-32 standard screws are required for a secondary hard drive. All other drives (except the primary hard drive) use M3 metric screws. The HP-supplied metric screws are black and the HP-supplied standard screws are silver. If you are replacing the primary hard drive, you must remove the four silver and blue 6-32 isolation mounting guide screws from the old hard drive and install them in the new hard drive.

Figure 5-13 Extra Guide Screw Locations



No.	Guide Screw	Device
1	Black M3 Metric Screws	All Drives (except primary and secondary hard drives)
2	Silver 6-32 Standard Screws	Secondary Hard Drive
There are at total of five extra silver 6-32 standard screws. Four are used as guide screws for a secondary hard drive. The fifth is used for bezel security.		

CAUTION: To prevent loss of work and damage to the computer or drive:

If you are inserting or removing a drive, shut down the operating system properly, turn off the computer, and unplug the power cord. Do not remove a drive while the computer is on or in standby mode.

Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Electrostatic Discharge Information on page 29.

Handle a drive carefully; do not drop it.

Do not use excessive force when inserting a drive.

Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

If a drive must be mailed, place the drive in a bubble-pack mailer or other protective packaging and label the package “Fragile: Handle With Care.”

Removing a 5.25-inch Drive from a Drive Bay

CAUTION: All removable media should be taken out of a drive before removing the drive from the computer.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Rotate the drive cage to its upright position.
4. If removing an optical drive, disconnect the power cable and data cable from the rear of the optical drive.

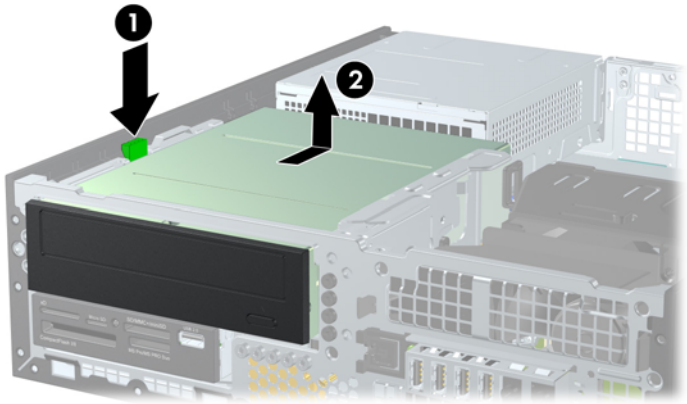
   CAUTION: When removing the cables, pull the tab or connector instead of the cable itself to avoid damaging the cable.

5. Rotate the drive cage back down to its normal position.

   CAUTION: Be careful not to pinch any cables or wires when rotating the drive cage down.

6. Press down on the green drive retainer button located on the left side of the drive to disengage the drive from the drive cage **(1)**. While pressing the drive retainer button, slide the drive back until it stops, then lift it up and out of the drive cage **(2)**.

Figure 5-14 Removing the 5.25-inch Drive



Installing a 5.25-inch Drive into a Drive Bay

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See Bezel Blanks on page 41 for more information.
4. Install four M3 metric guide screws in the lower holes on each side of the drive. HP has provided four extra M3 metric guide screws on the front of the chassis, under the front bezel. The M3 metric guide screws are black. Refer to Installing and Removing Drives on page 50 for an illustration of the extra M3 metric guide screws location.

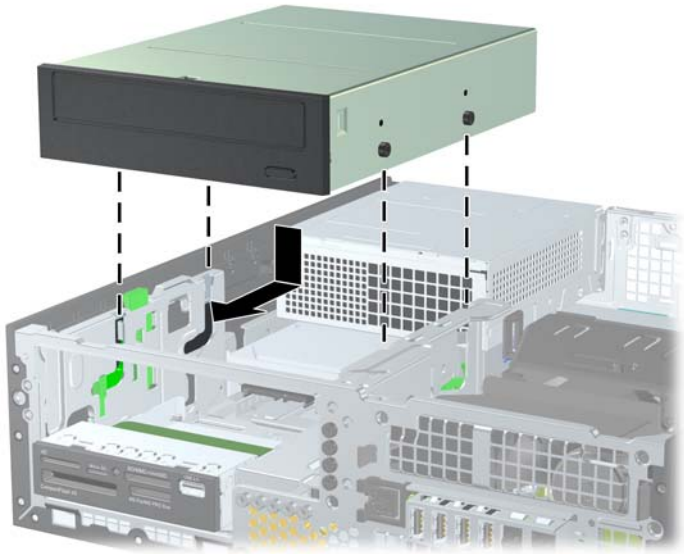
NOTE: When replacing the drive, transfer the four M3 metric guide screws from the old drive to the new one.

CAUTION: Use only 5-mm long screws as guide screws. Longer screws can damage the internal components of the drive.

Figure 5-15 Installing Guide Screws in the Optical Drive

5. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

Figure 5-16 Installing the Optical Drive



6. Rotate the drive cage to its upright position.
7. Connect the SATA data cable to the white SATA system board connector labeled SATA2.
8. Route the data cable through the cable guides.

CAUTION: There are two cable guides that keep the data cable from being pinched by the drive cage when raising or lowering it. One is located on the bottom side of the drive cage. The other is located on the chassis frame under the drive cage. Ensure that the data cable is routed through these guides before connecting it to the optical drive.

9. Connect the power cable and data cable to the rear of the optical drive.

NOTE: The power cable for the optical drive is a three-headed cable that is routed from the system board to the hard drive, then to the rear of the optical drive.

10. Rotate the drive cage back down to its normal position.

CAUTION: Be careful not to pinch any cables or wires when rotating the drive cage down.

11. Replace the front bezel (if removed) and access panel.
12. If the computer was on a stand, replace the stand.
13. Reconnect the power cord and turn on the computer.
14. Lock any security devices that were disengaged when the access panel was removed.

Removing a 3.5-inch Drive from a Drive Bay

CAUTION: All removable media should be taken out of a drive before removing the drive from the computer.

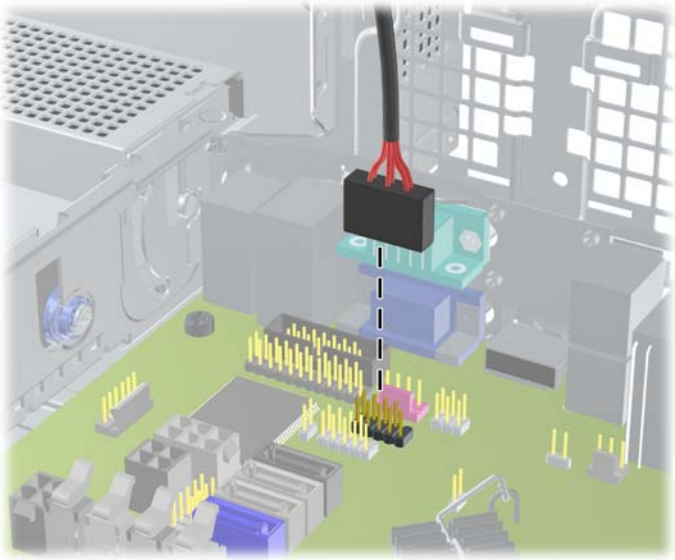
The 3.5-inch drive is located underneath the 5.25-inch drive. You must remove the 5.25-inch drive before removing the 3.5-inch drive.

1. Follow the procedure in Removing a 5.25-inch Drive from a Drive Bay on page 51 to remove the 5.25-inch drive and access the 3.5-inch drive.

CAUTION: Ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet before proceeding.

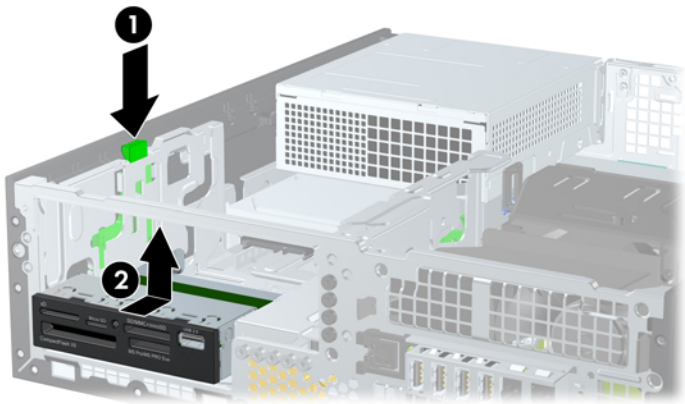
2. Disconnect the drive cables from the rear of the drive, or, if you are removing a media card reader, disconnect the USB cable from the system board as indicated in the following illustration.

Figure 5-17 Disconnecting the Media Card Reader USB Cable



3. Press down on the green drive retainer button located on the left side of the drive to disengage the drive from the drive cage **(1)**. While pressing the drive retainer button, slide the drive back until it stops, then lift it up and out of the drive cage **(2)**.

Figure 5-18 Removing a 3.5-inch Drive (Media Card Reader Shown)



Installing a 3.5-inch Drive into a Drive Bay

The 3.5-inch bay is located underneath the 5.25-inch drive. To install a drive into the 3.5-inch bay:

NOTE: Install guide screws to ensure the drive will line up correctly in the drive cage and lock in place. HP has provided extra guide screws for the drive bays (four 6-32 standard screws and four M3 metric screws), installed in the front of the chassis, under the front bezel. A secondary hard drive uses 6-32 standard screws. All other drives (except the primary hard drive) use M3 metric screws. The HP-supplied M3 metric screws are black and the HP-supplied 6-32 standard screws are silver. Refer to Installing and Removing Drives on page 50 for illustrations of the guide screw locations.

1. Follow the procedure in Removing a 5.25-inch Drive from a Drive Bay on page 51 to remove the 5.25-inch drive and access the 3.5-inch drive bay.

   CAUTION: Ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet before proceeding.

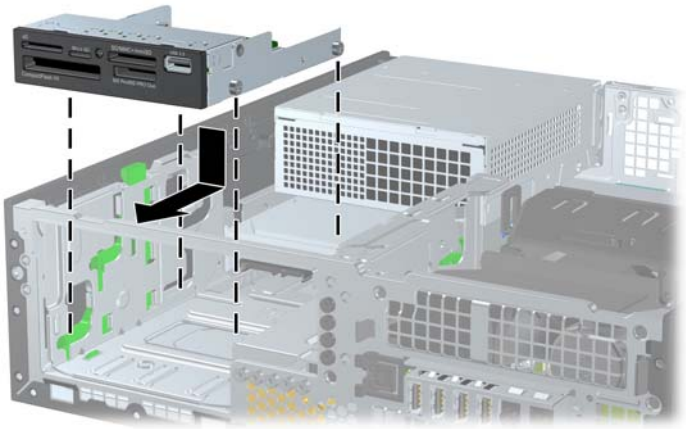
2. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See Bezel Blanks on page 41 for more information.

3. Install guide screws in the holes on each side of the drive.

   Figure 5-19 Installing Guide Screws (Media Card Reader Shown)

4. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

   Figure 5-20 Installing a Drive into the 3.5-inch Drive Bay (Media Card Reader Shown)

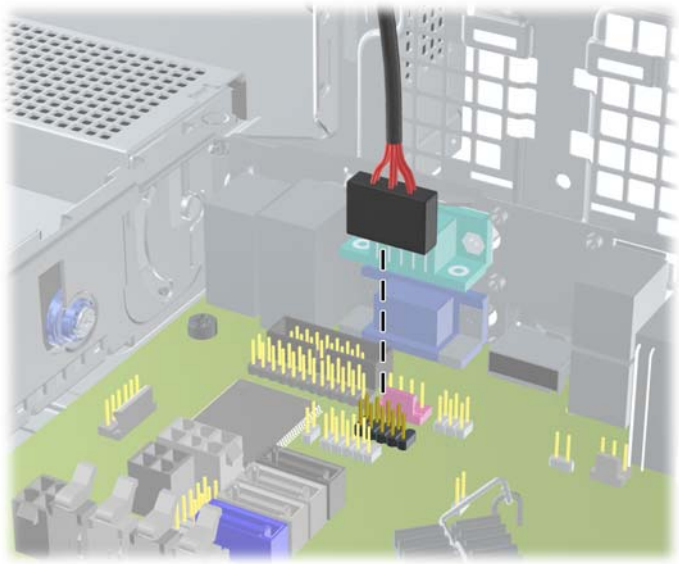
   

5. Connect the appropriate drive cables:

   a. If installing a second hard drive, connect the power cable and data cable to the rear of the drive and connect the other end of the data cable to the white connector on the system board labeled SATA1.

b. If installing a media card reader, connect the USB cable from the media card reader to the USB connector on the system board labeled MEDIA.

Figure 5-21 Connecting the Media Card Reader USB Cable



NOTE: Refer to System Board Connections on page 48 for an illustration of the system board drive connectors.

6. Replace the 5.25-inch drive.
7. Replace the front bezel (if removed) and access panel.
8. If the computer was on a stand, replace the stand.
9. Reconnect the power cord and turn on the computer.
10. Lock any security devices that were disengaged when the access panel was removed.

Removing and Replacing the Primary 3.5-inch Internal Hard Drive

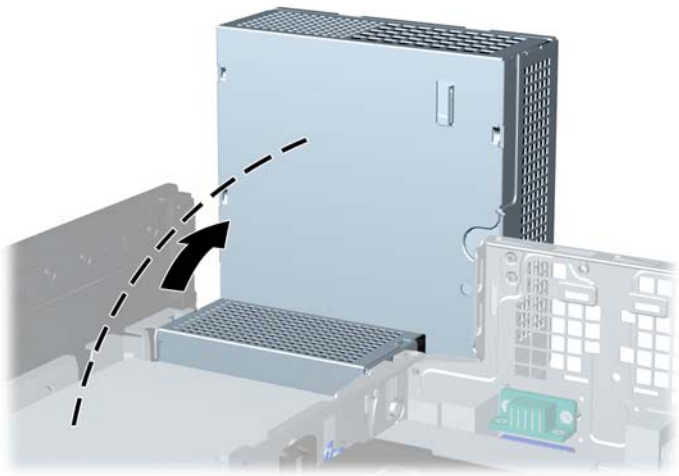
NOTE: Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive.

The preinstalled 3.5-inch hard drive is located under the power supply. To remove and replace the hard drive:

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Rotate the drive cage for internal drives to its upright position.

4. Rotate the power supply to its upright position. The hard drive is located beneath the power supply.

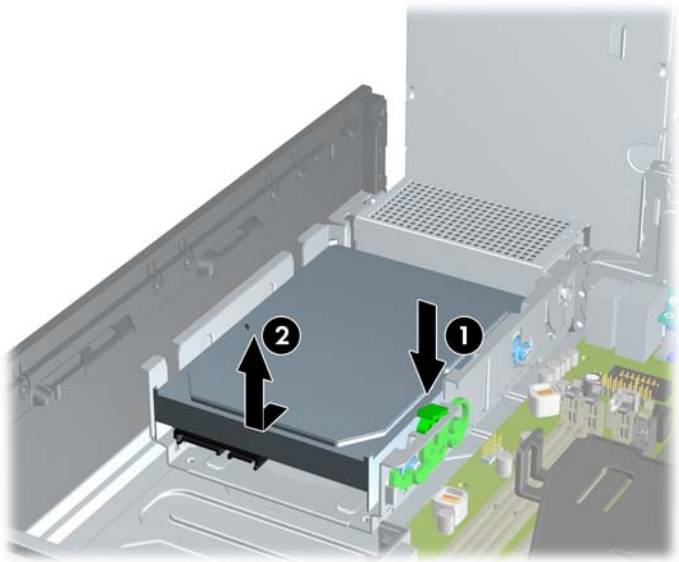
Figure 5-22 Raising the Power Supply



5. Disconnect the power cable and data cable from the back of the hard drive.

6. Press down on the green release latch next to the hard drive **(1)**. While holding the latch down, slide the drive forward until it stops, then lift the drive up and out of the bay **(2)**.

Figure 5-23 Removing the Hard Drive

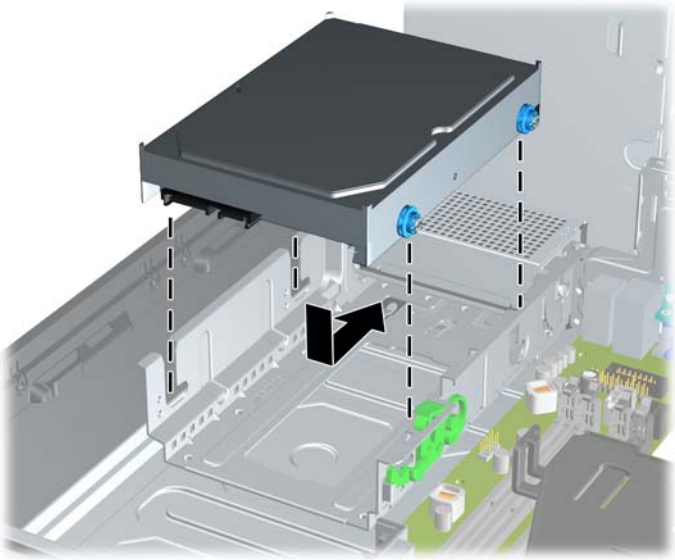


7. To install a hard drive, you must transfer the silver and blue isolation mounting guide screws from the old hard drive to the new hard drive.

Figure 5-24 Installing Hard Drive Guide Screws

8. Align the guide screws with the slots on the chassis drive cage, press the hard drive down into the bay, then slide it back until it stops and locks in place.

Figure 5-25 Installing the Hard Drive



9. Connect the power cable and data cable to the back of the hard drive.

NOTE: If the system has only one SATA hard drive, the data cable must be connected to the dark blue connector labeled SATA0 on the system board to avoid any hard drive performance problems.

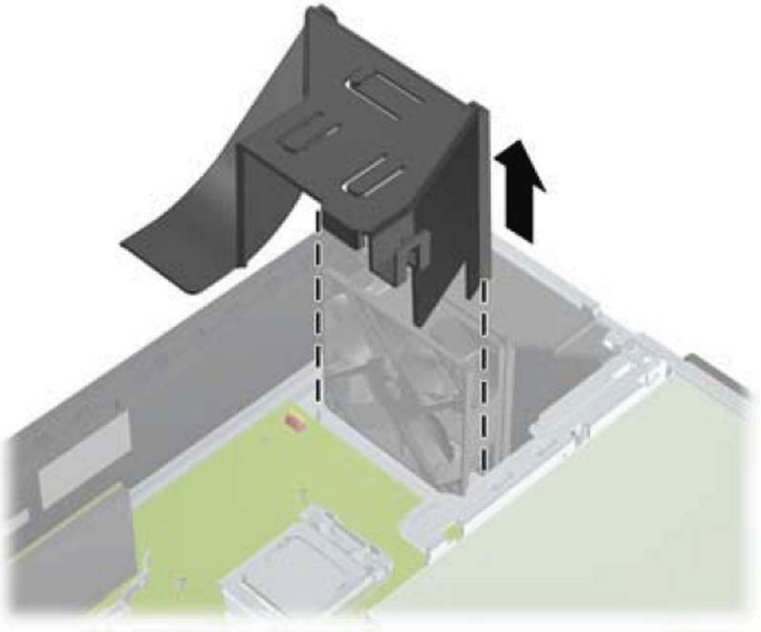
10. Rotate the drive cage for internal drives and the power supply down to their normal positions.
11. Replace the access panel.
12. If the computer was on a stand, replace the stand.
13. Reconnect the power cord and turn on the computer.
14. Lock any security devices that were disengaged when the access panel was removed.

Fan duct

The fan duct sits between the front fan and the heat sink.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Lift the fan duct straight up out of the chassis.

Figure 5-26 Removing the fan duct



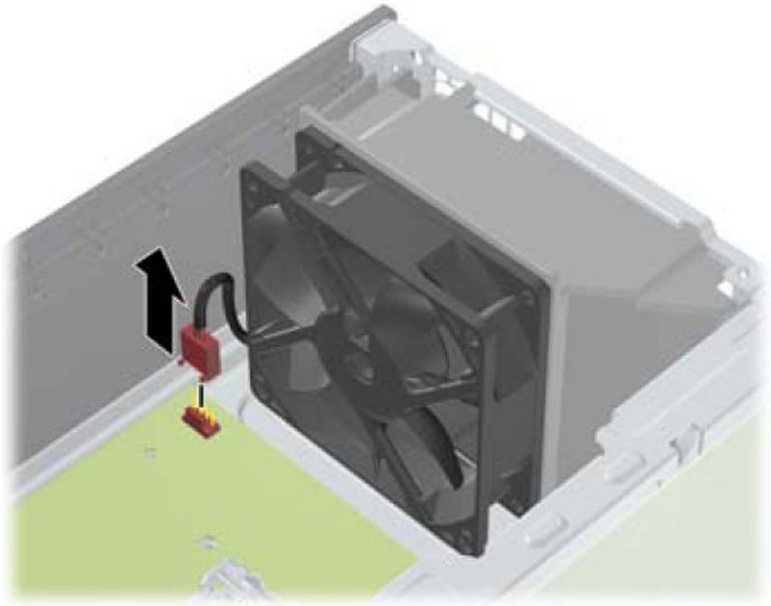
To install the fan duct, reverse the removal procedure.

Front Fan Assembly

The front fan assembly is attached to the front of the chassis.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Remove the front bezel (Front Bezel on page 40).
4. Remove the baffle (Fan duct on page 59).
5. Disconnect the fan cable from the red/brown system board connector labeled CHFAN1.

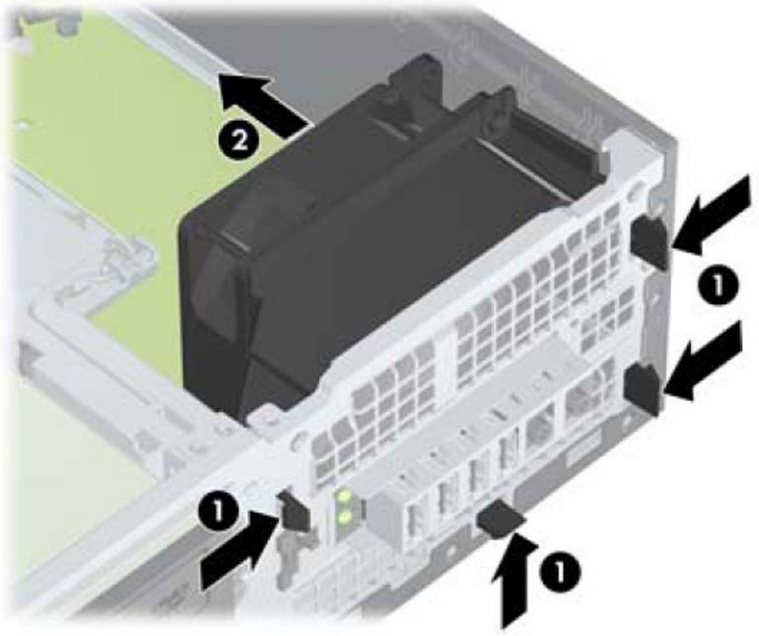
   Figure 5-27 Disconnecting the front fan cable



6. Press the tabs that secure the fan assembly to the front of the chassis **(1)**.

7. Pull the assembly toward the rear of the unit **(2)**, and then lift it out of the chassis.

Figure 5-28 Removing the front fan



To install the front fan, reverse the removal procedure. Be sure to orient the air flow into the unit.

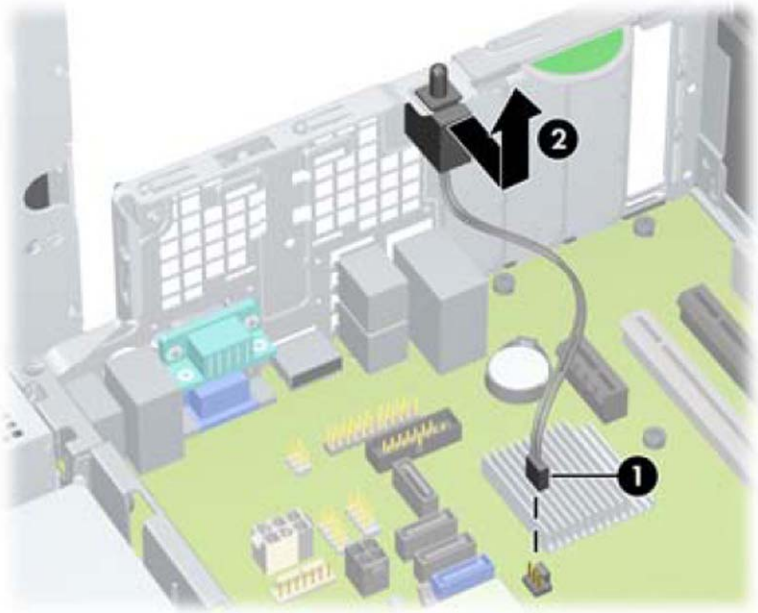
Hood Sensor

The hood sensor is attached in a slot in the rear of the chassis.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Unplug the sensor cable from the system board connector labeled HSENSE **(1)**.
4. Slide the hood sensor straight out of the notch in the chassis **(2)**.

NOTE: A flat blade screwdriver can be used to push the hood sensor out of the slot.

Figure 5-29 Removing the hood sensor from the chassis fan



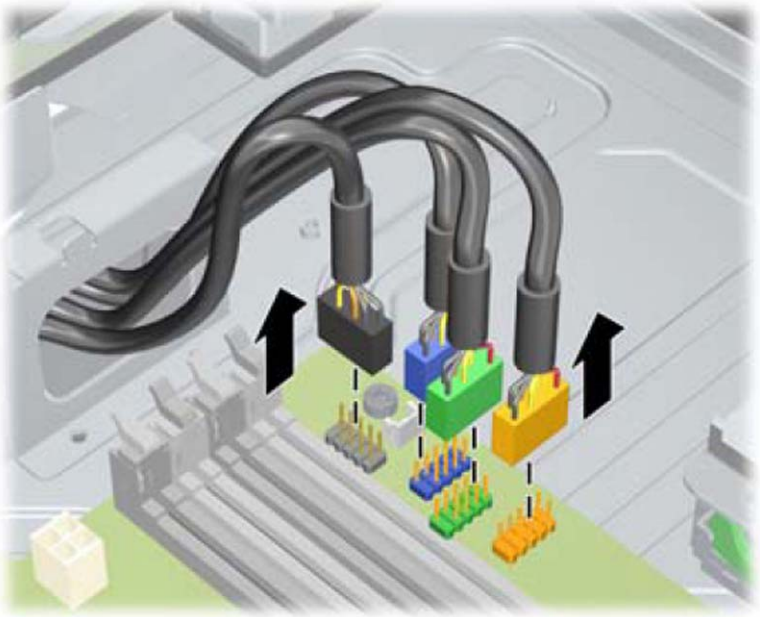
To install the hood sensor, reverse the removal procedure.

Front I/O, Power Switch Assembly

The front I/O and power switch/LEDs is one assembly, attached to the front of the chassis. Push the assembly into the chassis to remove.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Remove the front bezel (Front Bezel on page 40).
4. Remove the chassis fan (Front Fan Assembly on page 60).
5. Rotate the drive cage to its upright position.
6. Disconnect the four cables from the system board as follows:
   - Yellow connector labeled FRONT USB
   - Green connector labeled FRONT USB2
   - Blue connector labeled FRONT AUD
   - Black connector labeled PB/LED

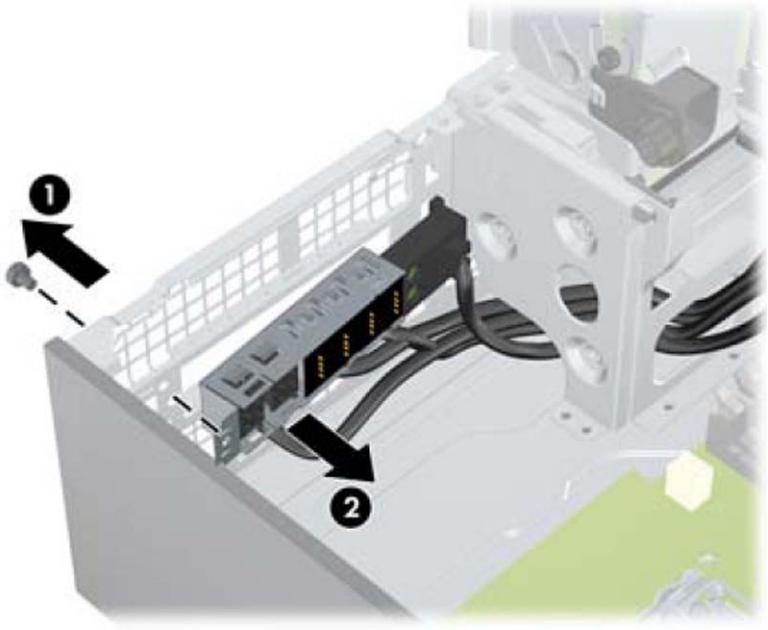
Figure 5-30 Disconnecting the front I/O, power switch/LED assembly cables



7. Remove the screw **(1)** that secures the assembly to the front of the chassis.

8. Route the cables through the slots beneath the drive cage, rotate the assembly into the chassis **(2)**, and then remove the assembly from the computer.

Figure 5-31 Removing the front I/O, power switch/LED assembly screw



To install the front I/O and power switch assembly, reverse the removal procedure.

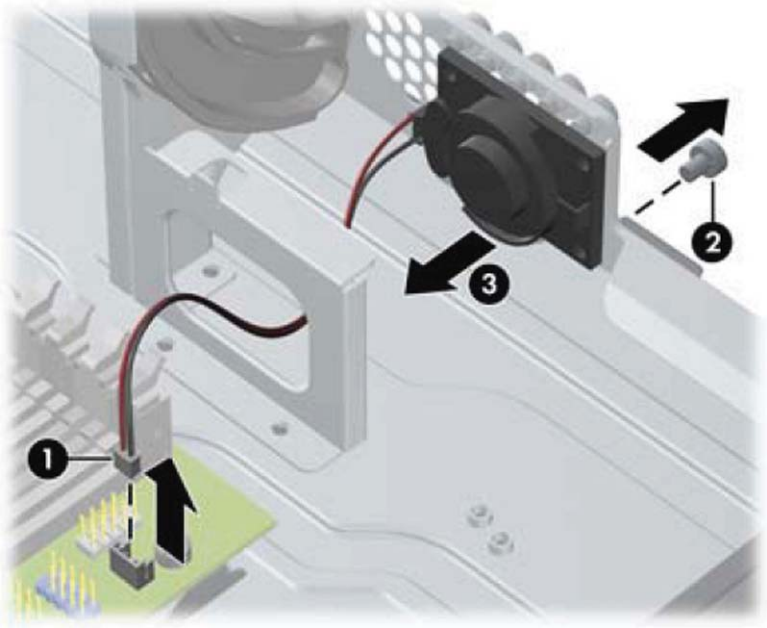
NOTE: Be sure to correctly route the cables beneath the drive cage when reinstalling the assembly. Proper cable routing prevents damage to the cables and allows the drive cage to close properly.

Speaker

The speaker is attached to the front of the chassis under the rotating drive cage.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Remove the front bezel (Front Bezel on page 40).
4. Rotate the drive cage to its upright position.
5. Disconnect the speaker wire from the system board labeled SPKR **(1)**.
6. Remove the screw that secures the speaker to the chassis **(2)**.
7. Lift the speaker from the inside of the chassis to remove it **(3)**.

Figure 5-32 Removing the speaker



To install the speaker, reverse the removal procedures.

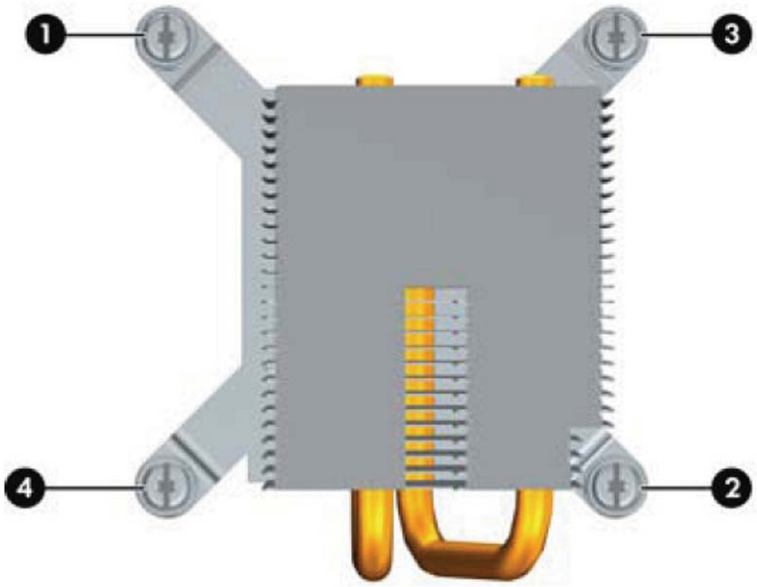
Heat sink

The heat sink is secured atop the processor with four captive Torx screws. The heat sink does not include a fan.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Remove the fan duct (Fan duct on page 59).
4. Remove the front fan (Front Fan Assembly on page 60).
5. In the order shown, loosen the four captive screws that secure the heat sink to the system board tray.

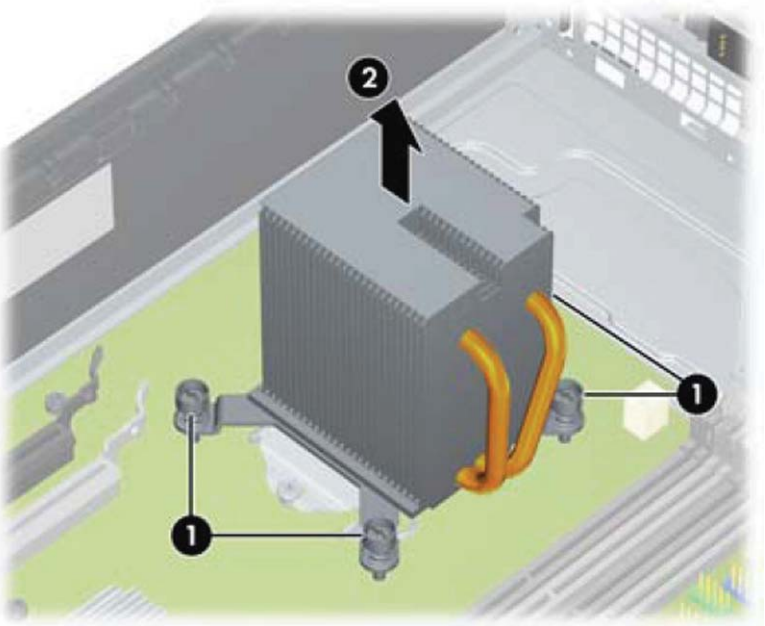
⚠ **CAUTION:** Heat sink retaining screws should be removed in diagonally opposite pairs (as in an X) to even the downward forces on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

Figure 5-33 Loosening the heat sink screws



6. After loosening the screws **(1)**, lift the heat sink from atop the processor **(2)** and set it on its side to keep from contaminating the work area with thermal grease.

Figure 5-34 Removing the heat sink



When reinstalling the heat sink, make sure that its bottom has been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor.

⚠ **CAUTION:** Heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink on the processor to avoid damage that could require replacing the system board.

Failure to install the fan duct may cause the computer to overheat.

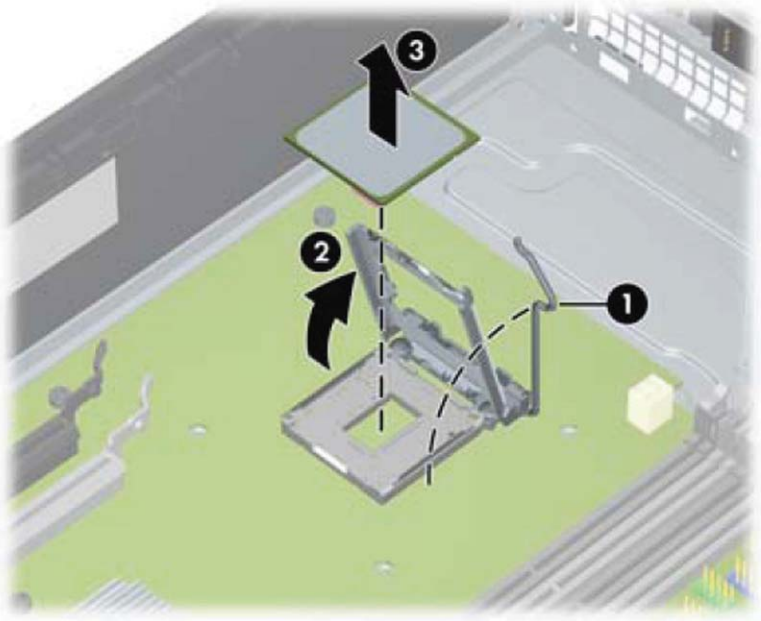
Processor

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Remove the fan duct (Fan duct on page 59).
4. Remove the front fan assembly (Front Fan Assembly on page 60).
5. Remove the heat sink (Heat sink on page 66).
6. Rotate the locking lever to its full open position **(1)**.
7. Raise and rotate the microprocessor retainer to its fully open position **(2)**.
8. Carefully lift the processor from the socket **(3)**.

CAUTION: Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

The heat sink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.

Figure 5-35 Removing the processor

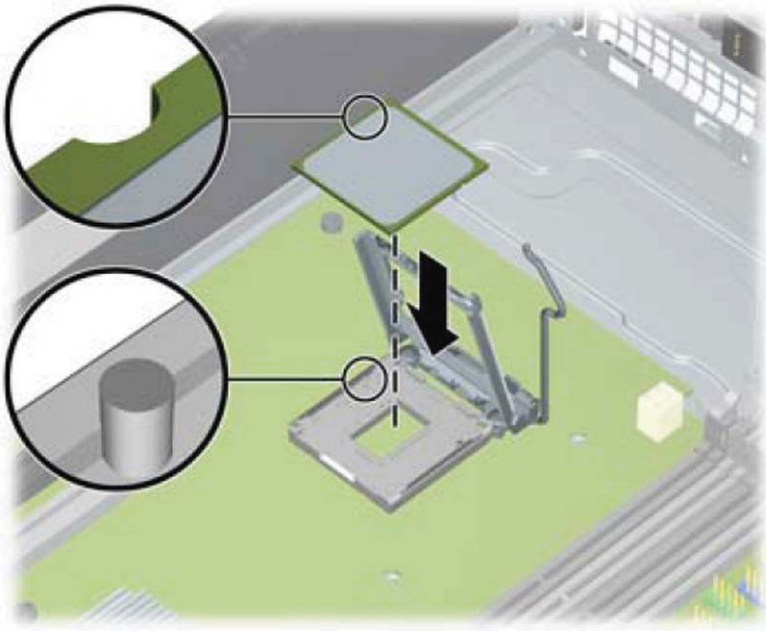


To install a new processor:

1. Place the processor in its socket and close the retainer. Make sure the slot in the processor fits into the post on the socket.

2. Secure the locking lever. If reusing the existing heat sink, go to step 3. If using a new heat sink, go to step 6.

Figure 5-36 Removing the processor



3. If reusing the existing heat sink, clean the bottom of the heat sink with the alcohol pad provided in the spares kit.

CAUTION: Before reinstalling the heat sink you must clean the top of the processor and the bottom of the heat sink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

4. Apply the thermal grease provided in the spares kit to the top of the processor and install the heat sink atop the processor.

5. Go to step 7.

6. If using a new heat sink, remove the protective covering from the bottom of the heat sink and place it in position atop the processor.

7. Secure the heat sink to the system board and system board tray.

CAUTION: Heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

NOTE: After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system BIOS can be found on the Web at: http://h18000.www1.hp.com/support/files.

Power Supply

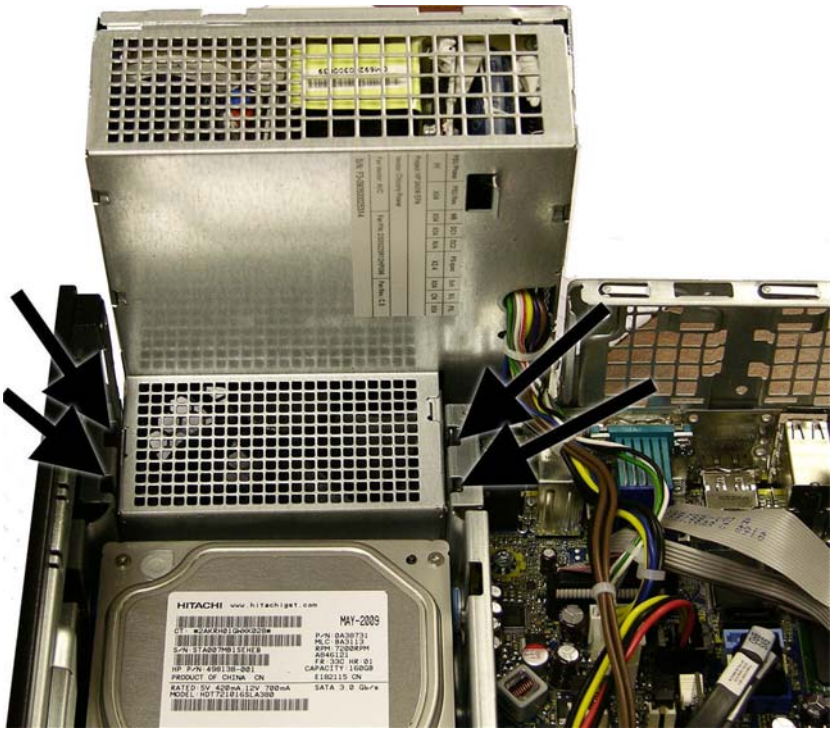
WARNING! To reduce potential safety issues, only the power supply provided with the computer, a replacement power supply provided by HP, or a power supply purchased as an accessory from HP should be used with the computer.

The rotating power supply is located at the rear of the chassis. It is held in place by a bracket – no screws are used.

WARNING! Voltage is always present on the system board when the computer is plugged into an active AC outlet. To avoid possible personal injury and damage to the equipment the power cord should be disconnected from the computer and/or the AC outlet before opening the computer.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. Rotate the drive cage up and disconnect the power cables from all of the drives.
4. Disconnect all power cables from the system board as follows:
   - white 4-pin PWRCPU
   - white 4-pin PWR
   - white 6-pin PWRCMD
5. Rotate the power supply to its full upright position.
6. Release the power supply cables from the cable retaining clip under the drive cage.
7. Pull the power supply forward until the posts on the power supply move forward in the power supply bracket, and then lift the power supply straight up and out of the chassis.

Figure 5-37 Removing the power supply



To install the power supply, reverse the removal procedure.

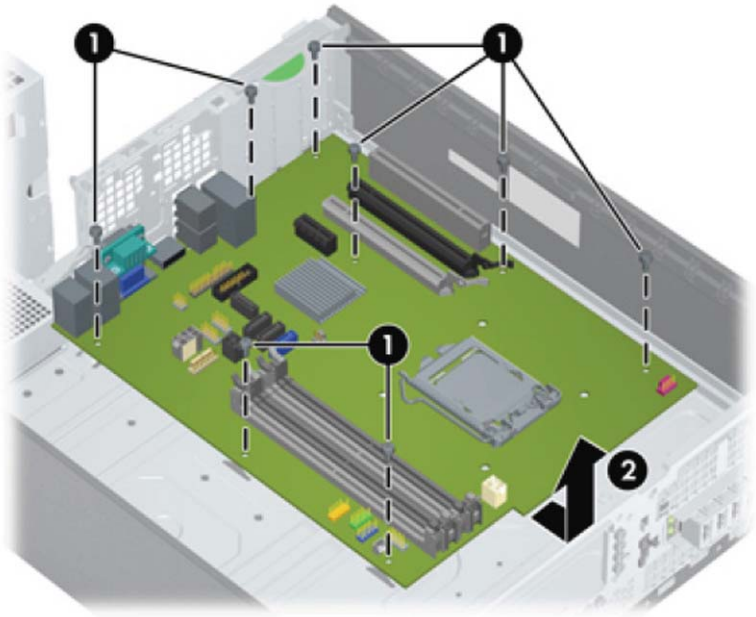
⚠ **CAUTION:** When installing the power supply cables, make sure they are properly positioned so they are not cut by the drive cage and are not pinched by the rotating power supply.

System Board

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).
3. When replacing the system board, make sure the following components are removed from the defective system board and installed on the replacement system board:
   - Memory modules (seeMemory on page 41)
   - Expansion cards (Expansion Card on page 44)
   - Heat sink (Heat sink on page 66)
   - Processor (Processor on page 68)
4. Remove the baffle from the chassis (Fan duct on page 59).
5. Remove the fan from the chassis (Front Fan Assembly on page 60).
6. Rotate the drive cage to its upright position.
7. Rotate the power supply to its full upright position.
8. Disconnect all data and power cables from the system board.
9. Disconnect the balance of the cables from the system board.
10. Remove the eight screws **(1)** that secure the system board to the chassis.

11. Lift up the front of the system board, and then pull the system board forward, up, and out of the chassis **(2)**.

Figure 5-38 Removing the system board



To install the system board, reverse the removal procedure.

NOTE: When replacing the system board, you must also change the chassis serial number in the BIOS.

CAUTION: Before reinstalling the heat sink you must clean the top of the processor and the bottom of the heat sink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

CAUTION: When reconnecting the cables it is important that they be positioned so they do not interfere with the rotation of the drive cage or power supply.

Battery

The battery that comes with your computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer. The computer comes with a 3-volt lithium coin cell battery.

NOTE: The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

WARNING! This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery is not handled properly. To reduce the risk of personal injury:

Do not attempt to recharge the battery.

Do not expose to temperatures higher than 140°F (60°C).

Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

Replace the battery only with the HP spare designated for this product.

CAUTION: Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

NOTE: HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries. For more information about recycling programs, go to http://www.hp.com/recycle.

CAUTION: Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).
2. Remove the access panel (Access Panel on page 39).

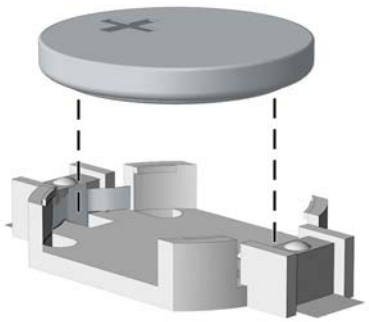
   NOTE: It may be necessary to remove an expansion card to gain access to the battery.

3. Locate the battery and battery holder on the system board.
4. Depending on the type of battery holder on your system board, complete the following instructions to replace the battery:

Type 1 Battery Holder

1. Lift the battery out of its holder.

   Figure 5-39 Removing the battery from a type 1 holder



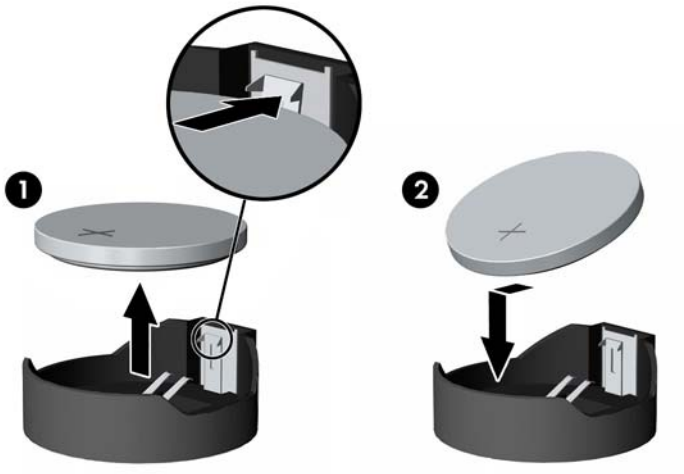
2. Slide the replacement battery into position, positive side up.
3. The battery holder automatically secures the battery in the proper position.
4. Replace the computer access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to Computer Setup (F10) Utility on page 16.

Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp that extends above one edge of the battery. When the battery pops up, lift it out **(1)**.

2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up **(2)**. Push the other edge down until the clamp snaps over the other edge of the battery.

Figure 5-40 Removing the battery from a type 2 holder

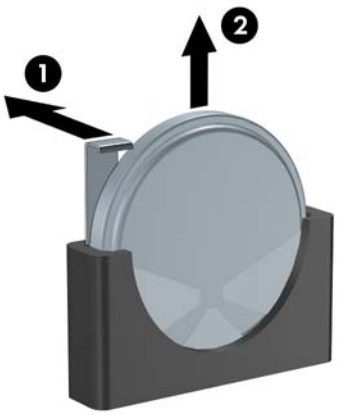


3. Replace the computer access panel.
4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to Computer Setup (F10) Utility on page 16.

Type 3 Battery Holder

1. Pull back on the clip **(1)** that holds the battery in place, then remove the battery **(2)**.
2. Insert the new battery and position the clip back in place.

Figure 5-41 Removing the battery from a type 3 holder



3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.

5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to Computer Setup (F10) Utility on page 16.

Using the Small Form Factor Computer in a Tower Orientation

The Small Form Factor computer can be used in a tower orientation. The HP logo plate on the front bezel is adjustable for either desktop or tower orientation.

1. Prepare the computer for disassembly (Preparation for Disassembly on page 38).

2. Orient the computer so that its right side is facing down and place the computer in the optional stand.

Figure 5-42 Changing from Desktop to Tower Orientation

NOTE: To stabilize the computer in a tower orientation, HP recommends the use of the optional tower stand.

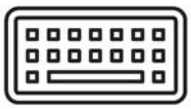
3. Lock any security devices that were disengaged when the access panel was removed.

NOTE: Ensure at least 10.2 centimeters (4 inches) of space on all sides of the computer remains clear and free of obstructions.

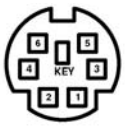
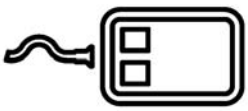
A Connector Pin Assignments

This appendix contains the pin assignments for computer connectors. Some of these connectors may not be used on the product being serviced.

Keyboard

Connector and Icon	Pin	Signal
	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

Mouse

Connector and Icon	Pin	Signal
 	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

Ethernet RJ-45

Connector and Icon	Pin	Signal
	1	(+) Transmit Data
	2	(-) Transmit Data
	3	(+) Receive Data
	4	Unused
	5	Unused
	6	(-) Receive Data
	7	Unused
	8	Unused

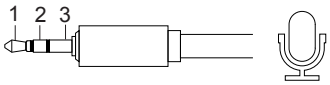
Serial Interface, Powered and Non-Powered

Connector and Icon	Pin	Signal
	1	Carrier Detect (12V if powered)
	2	Receive Data
	3	Transmit Data
	4	Data Terminal Ready
	5	Signal Ground
	6	Data Set Ready
	7	Request to Send
	8	Clear to Send
	9	Ring Indicator (5V if powered)

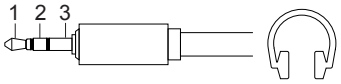
USB

Connector and Icon	Pin	Signal
	1	+5 VDC
	2	- Data
	3	+ Data
	4	Ground

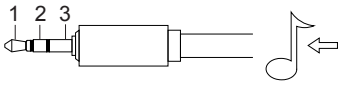
Microphone

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Audio_Right
	3 (Shield)	Ground

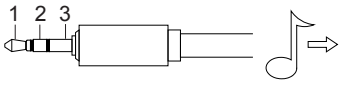
Headphone

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Power_Right
	3 (Shield)	Ground

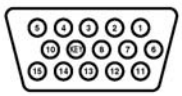
Line-in Audio

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_In_Left
	2 (Ring)	Audio_In_Right
	3 (Shield)	Ground

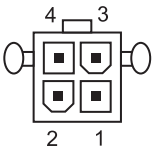
Line-out Audio

Connector and Icon (1/8” miniphone)	Pin	Signal
	1 (Tip)	Audio_Out_Left
	2 (Ring)	Audio_Out_Right
	3 (Shield)	Ground

Monitor

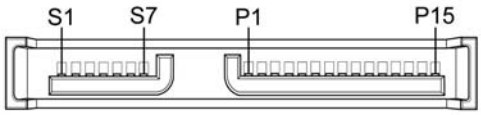
Connector and Icon			
			
Pin	**Signal**	**Pin**	**Signal**
1	Red Analog	9	+5V (fused)
2	Green Analog	10	Ground
3	Blue Analog	11	Not used
4	Not used	12	DDC Serial Data
5	Ground	13	Horizontal Sync
6	Ground	14	Vertical Sync
7	Ground	15	DDC Serial Clock
8	Ground		

4-Pin Power (for CPU)

Connector and Icon	Pin	Signal
	1	GND
	2	GND
	3	+12V CPU
	4	-12V CPU

SATA Data and Power

Drive Connector

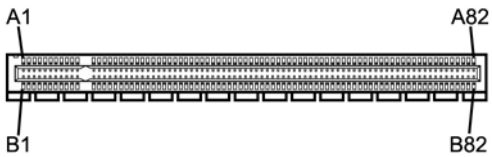


Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
S1	Ground	S2	A+	S3	A-	S4	Ground
S5	B-	S6	B+	S7	Ground		
P1	Ground	P2	V 3.3	P3	V 3.3	P4	Ground
P5	B-	P6	Ground	P7	V 5	P8	V 5
P9	V 5	P10	Ground	P11	Reserved	P12	Ground
P13	V 12	P14	V12	P15	V 12		

*S = Data, P = Power

PCI Express

x1, x4, x8, and x16 PCI Express Connector



Pin A

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PRSNT1	6	JTAG3	11	PERST#	16	PERp0	21	PERp1
2	+12V	7	JTAG4	12	GND	17	PERn0	22	PERn1
3	+12V	8	JTAG5	13	REFCLK+	18	GND	23	GND
4	GND	9	+3.3V	14	REFCLK-	19	RSVD	24	GND
5	JTAG2	10	+3.3V	15	GND	20	GND	25	PERp2
26	PERn(2)	31	GND	36	PERn4	41	GND	46	GND
27	GND	32	RSVD	37	GND	42	GND	47	PERp7
28	GND	33	RSVD	38	GND	43	PERp6	48	PERn7
29	PERp3	34	GND	39	PERp5	44	PERn6	49	GND
30	PERn3	35	PERp4	40	PERn5	45	GND	50	RSVD
51	GND	56	PERp9	61	PERn10	66	GND	71	GND
52	PERp8	57	PERn9	62	GND	67	GND	72	PERp13
53	PERN8	58	GND	63	GND	68	PERp12	73	PERn13
54	GND	59	GND	64	PERp11	69	PERn12	74	GND
55	GND	60	PERp10	65	PERn11	70	GND	75	GND
76	PERp14	81	PERn15						
77	PERn14	82	GND						
78	GND								
79	GND								
80	PERp15								

Pin B information is on the next page

NOTE: x1 PCI Express uses pins 1-18

x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

PCI Express

x1, x4, x8, and x16 PCI Express Connector

Pin B

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+12V	6	SMDAT	11	WAKE#	16	GND	21	GND
2	+12V	7	GND	12	RSVD	17	GND	22	GND
3	RSVD	8	+3.3 V	13	GND	18	PETp1	23	PETp2
4	GND	9	JTAG1	14	PETp0	19	PETn1	24	PETn2
5	SMCLK	10	3.3vAux	15	PETn0	20		25	GND
26	GND	31	PRSNT2#	36	GND	41	PETp6	46	PETn7
27	PETp3	32	GND	37	PETp5	42	PRTn6	47	GND
28	PETn3	33	PETp4	38	PETn5	43	GND	48	PRSNT2#
29	GND	34	PETn4	39	GND	44	GND	49	GND
30	RSVD	35	GND	40	GND	45	PETp7	50	PETp8
51	PETn8	56	GND	61	GND	66	PETp12	71	PETn13
52	GND	57	GND	62	PETp11	67	PETn12	72	GND
53	GND	58	PETp10	63	PETn11	68	GND	73	GND
54	PETp9	59	PETn10	64	GND	69	GND	74	PETp14
55	PETn9	60	GND	65	GND	70	PETp13	75	PETn14
76	GND	81	PRSNT2#						
77	GND	82	RSVD						
78	PETp15								
79	PETn15								
80	GND								

Pin B information is on the next page

NOTE: x1 PCI Express uses pins 1-18

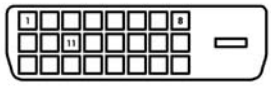
x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

DVI Connector

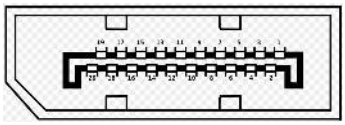
Connector and Icon



Pin	Signal	Pin	Signal
1	T.M.D.S. Data2–	13	T.M.D.S. Data3+
2	T.M.D.S. Data2+	14	+5V Power
3	T.M.D.S. Data2/4 Shield	15	Ground (for +5V)
4	T.M.D.S. Data4–	16	Hot Pug Detect
5	T.M.D.S. Data4+	17	T.M.D.S. Data0–
6	DDC Clock	18	T.M.D.S. Data0+
7	DDC Data	19	T.M.D.S. Data0/5 Shield
8	No Connect	20	T.M.D.S. Data5–
9	T.M.D.S. Data1–	21	T.M.D.S. Data5+
10	T.M.D.S. Data1+	22	T.M.D.S. Data Shield
11	T.M.D.S. Data1/3 Shield	23	T.M.D.S. Clock+
12	T.M.D.S. Data3–	24	T.M.D.S. Clock-

DisplayPort Connector

Connector and Icon



Pin	Signal	Pin	Signal
1	ML_Lane 0 (p)	13	CONFIG1
2	Ground	14	CONFIG2
3	ML_Lane 0 (n)	15	AUX CH (p)
4	ML_Lane 1 (p)	16	Ground
5	Ground	17	AUX CH (n)
6	ML_Lane 1 (n)	18	Hot Plug
7	ML_Lane 2 (p)	19	Return
8	Ground	20	DP_PWR
9	ML_Lane 2 (n)		
10	ML_Lane 3 (p)		
11	Ground		
12	ML_Lane 3 (n)		

B Power Cord Set Requirements

The power supplies on some computers have external power switches. The voltage select switch feature on the computer permits it to operate from any line voltage between 100-120 or 220-240 volts AC. Power supplies on those computers that do not have external power switches are equipped with internal switches that sense the incoming voltage and automatically switch to the proper voltage.

The power cord set received with the computer meets the requirements for use in the country where you purchased the equipment.

Power cord sets for use in other countries must meet the requirements of the country where you use the computer.

General Requirements

The requirements listed below are applicable to all countries:

1. The power cord must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be installed.
2. The power cord set must have a minimum current capacity of 10A (7A Japan only) and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.
3. The diameter of the wire must be a minimum of 0.75 mm_2 or 18AWG, and the length of the cord must be between 1.8 m (6 feet) and 3.6 m (12 feet).

The power cord should be routed so that it is not likely to be walked on or pinched by items placed upon it or against it. Particular attention should be paid to the plug, electrical outlet, and the point where the cord exits from the product.

⚠ **WARNING!** Do not operate this product with a damaged power cord set. If the power cord set is damaged in any manner, replace it immediately.

Japanese Power Cord Requirements

For use in Japan, use only the power cord received with this product.

⚠ **CAUTION:** Do not use the power cord received with this product on any other products.

Country-Specific Requirements

Additional requirements specific to a country are shown in parentheses and explained below.

Country	Accrediting Agency	Country	Accrediting Agency
Australia (1)	EANSW	Italy (1)	IMQ
Austria (1)	OVE	Japan (3)	METI
Belgium (1)	CEBC	Norway (1)	NEMKO
Canada (2)	CSA	Sweden (1)	SEMKO
Denmark (1)	DEMKO	Switzerland (1)	SEV
Finland (1)	SETI	United Kingdom (1)	BSI
France (1)	UTE	United States (2)	UL
Germany (1)	VDE		

1. The flexible cord must be Type HO5VV-F, 3-conductor, 0.75mm_2 conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country where it will be used.
2. The flexible cord must be Type SVT or equivalent, No. 18 AWG, 3-conductor. The wall plug must be a two-pole grounding type with a NEMA 5-15P (15A, 125V) or NEMA 6-15P (15A, 250V) configuration.
3. Appliance coupler, flexible cord, and wall plug must bear a “T” mark and registration number in accordance with the Japanese Dentori Law. Flexible cord must be Type VCT or VCTF, 3-conductor, 0.75 mm_2 conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7A, 125V) configuration.

C POST Error Messages

This appendix lists the error codes, error messages, and the various indicator light and audible sequences that you may encounter during Power-On Self-Test (POST) or computer restart, the probable source of the problem, and steps you can take to resolve the error condition.

POST Message Disabled suppresses most system messages during POST, such as memory count and non-error text messages. If a POST error occurs, the screen will display the error message. To manually switch to the POST Messages Enabled mode during POST, press any key (except F10, F11, or F12). The default mode is POST Message Disabled.

The speed at which the computer loads the operating system and the extent to which it is tested are determined by the POST mode selection.

Quick Boot is a fast startup process that does not run all of the system level tests, such as the memory test. Full Boot runs all of the ROM-based system tests and takes longer to complete.

Full Boot may also be enabled to run every 1 to 30 days on a regularly scheduled basis. To establish the schedule, reconfigure the computer to the Full Boot Every x Days mode, using Computer Setup.

NOTE: For more information on Computer Setup, see Computer Setup (F10) Utility on page 16.

POST Numeric Codes and Text Messages

This section covers those POST errors that have numeric codes associated with them. The section also includes some text messages that may be encountered during POST.

NOTE: The computer will beep once after a POST text message is displayed on the screen.

Table C-1 Numeric Codes and Text Messages

Control panel message	Description	Recommended action
101-Option ROM Checksum Error	System ROM or expansion board option ROM checksum.	1. Verify the correct ROM. 2. Flash the ROM if needed. 3. If an expansion board was recently added, remove it to see if the problem remains. 4. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 5. If the message disappears, there may be a problem with the expansion card. 6. Replace the system board.
103-System Board Failure	DMA or timers.	1. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 2. Remove expansion boards. 3. Replace the system board.
110-Out of Memory Space for Option ROMs	Recently added PCI expansion card contains an option ROM too large to download during POST.	1. If a PCI expansion card was recently added, remove it to see if the problem remains. 2. In Computer Setup, set **Advanced** > **Device Options** > **NIC PXE Option ROM Download** to **DISABLE** to prevent PXE option ROM for the internal NIC from being downloaded during POST to free more memory for an expansion card's option ROM. Internal PXE option ROM is used for booting from the NIC to a PXE server.
162-System Options Not Set	Configuration incorrect. RTC (real-time clock) battery may need to be replaced.	Run Computer Setup and check the configuration in **Advanced** > **Onboard Devices**. Reset the date and time under **Control Panel**. If the problem persists, replace the RTC battery. See the Removal and Replacement section for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
163-Time & Date Not Set	Invalid time or date in configuration memory. RTC (real-time clock) battery may need to be replaced.	Reset the date and time under **Control Panel** (Computer Setup can also be used). If the problem persists, replace the RTC battery. See the Removal and Replacement section for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.
163-Time & Date Not Set	CMOS jumper may not be properly installed.	Check for proper placement of the CMOS jumper if applicable.
164-MemorySize Error	Memory amount has changed since the last boot (memory added or removed).	Press the F1 key to save the memory changes.
164-MemorySize Error	Memory configuration incorrect.	1. Run Computer Setup utilities. 2. Make sure the memory module(s) are installed properly. 3. If third-party memory has been added, test using HP-only memory. 4. Verify proper memory module type.
201-Memory Error	RAM failure.	1. Ensure memory modules are correctly installed. 2. Verify proper memory module type. 3. Remove and replace the identified faulty memory module(s). 4. If the error persists after replacing memory modules, replace the system board.
213-Incompatible Memory Module in Memory Socket(s) X, X, ...	A memory module in memory socket identified in the error message is missing critical SPD information, or is incompatible with the chipset.	1. Verify proper memory module type. 2. Try another memory socket. 3. Replace DIMM with a module conforming to the SPD standard.
214-DIMM Configuration Warning	Populated DIMM Configuration is not optimized.	Rearrange the DIMMs so that each channel has the same amount of memory.
219-ECC Memory Module Detected ECC Modules not supported on this Platform	Recently added memory module(s) support ECC memory error correction.	1. If additional memory was recently added, remove it to see if the problem remains. 2. Check product documentation for memory support information.
301-Keyboard Error	Keyboard failure.	1. Reconnect keyboard with computer turned off. 2. Check connector for bent or missing pins. 3. Ensure that none of the keys are depressed. 4. Replace keyboard.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
303-Keyboard Controller Error	I/O board keyboard controller.	1. Reconnect keyboard with computer turned off. 2. Replace the system board.
304-Keyboard or System Unit Error	Keyboard failure.	1. Reconnect the keyboard with computer turned off. 2. Ensure that none of the keys are depressed. 3. Replace the keyboard. 4. Replace the system board.
501-Display Adapter Failure	Graphics display controller.	1. Reseat the graphics card (if applicable). 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 3. Verify monitor is attached and turned on. 4. Replace the graphics card (if possible).
510-Flash Screen Image Corrupted	Flash Screen image has errors.	Reflash the system ROM with the latest BIOS image.
511-CPU, CPUA, or CPUB Fan not Detected	CPU fan is not connected or may have malfunctioned.	1. Reseat CPU fan. 2. Reseat fan cable. 3. Replace CPU fan.
512-Chassis, Rear Chassis, or Front Chassis Fan not Detected	Chassis, rear chassis, or front chassis fan is not connected or may have malfunctioned.	1. Reseat chassis, rear chassis, or front chassis fan. 2. Reseat fan cable. 3. Replace chassis, rear chassis, or front chassis fan.
513-Front Chassis fan not detected	Front chassis fan is not connected or may have malfunctioned.	1. Reseat front chassis fan. 2. Reseat fan cable. 3. Replace front chassis fan.
514-CPU or Chassis Fan not Detected	CPU or chassis fan is not connected or may have malfunctioned.	1. Reseat CPU or chassis fan. 2. Reseat fan cable. 3. Replace CPU or chassis fan.
515-Power Supply fan not detected	Power supply fan is not connected or may have malfunctioned.	1. Reseat power supply fan. 2. Reseat fan cable. 3. Replace power supply fan.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
601-Diskette Controller Error	Diskette controller circuitry or floppy drive circuitry incorrect.	1. Check and/or replace cables. 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 3. Replace diskette drive. 4. Replace the system board.
605-Diskette Drive Type Error	Mismatch in drive type.	1. Disconnect any other diskette controller devices (tape drives). 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.)
660-Display cache is detected unreliable	Integrated graphics controller display cache is not working properly and will be disabled.	Replace system board if minimal graphics degrading is an issue.
912-Computer Cover Has Been Removed Since Last System Startup	Computer cover was removed since last system startup.	No action required.
917-Front Audio Not Connected	Front audio harness has been detached or unseated from motherboard.	Reconnect or replace front audio harness.
918-Front USB Not Connected	Front USB harness has been detached or unseated from motherboard.	Reconnect or replace front USB harness.
921-Device in PCI Express slot failed to initialize	There is an incompatibility/problem with this device and the system or PCI Express Link could not be retrained to an x1.	Try rebooting the system. If the error reoccurs, the device may not work with this system
1151-Serial Port A Address Conflict Detected	Both external and internal serial ports are assigned to COM1.	1. Remove any serial port expansion cards. 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 3. Reconfigure card resources and/or run Computer Setup utilities.
1152-Serial Port B Address Conflict Detected	Both external and internal serial ports are assigned to COM2.	1. Remove any serial port expansion cards. 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 3. Reconfigure card resources and/or run Computer Setup utilities.
1155-Serial Port Address Conflict Detected	Both external and internal serial ports are assigned to same IRQ.	1. Remove any serial port expansion cards. 2. Clear CMOS. (See Appendix B, Password Security and Resetting CMOS on page 100.) 3. Reconfigure card resources and/or run Computer Setup utilities.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
1720-SMART Hard Drive Detects Imminent Failure	Hard drive is about to fail. (Some hard drives have a hard drive firmware patch that will fix an erroneous error message.)	1. Determine if hard drive is giving correct error message. Enter Computer Setup and run the Drive Protection System test under **Storage** > **DPS Self-test**. 2. Apply hard drive firmware patch if applicable. (Available at http://www.hp.com/support.) 3. Back up contents and replace hard drive.
1796-SATA Cabling Error	One or more SATA devices are improperly attached. For optimal performance, the SATA 0 and SATA 1 connectors must be used before SATA 2 and SATA 3.	Ensure SATA connectors are used in ascending order. For one device, use SATA 0. For two devices, use SATA 0 and SATA 1. For three devices, use SATA 0, SATA 1, and SATA 2.
1797-SATA Drivelock is not supported in RAID mode.	Drivelock is enabled on one or more SATA hard drives, and they cannot be accessed while the system is configured for RAID mode.	Either remove the Drivelocked SATA device or disable the Drivelock feature. To disable the Drivelock feature, enter Computer Setup, change **Storage** > **Storage Options** > **SATA Emulation** to **IDE**, and select **File** > **Save Changes and Exit**. Reenter Computer Setup and select **Security** > **Drivelock Security**. For each listed Drivelock-capable SATA device, ensure Drivelock is **Disabled**. Lastly, change **Storage** > **Storage Options** > **SATA Emulation** back to **RAID** and select **File** > **Save Changes and Exit**.
1801-Microcode Patch Error	Processor is not supported by ROM BIOS.	1. Upgrade BIOS to proper version. 2. Change the processor.
2200-PMM Allocation Error during MEBx Download	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	1. Reboot the computer. 2. Unplug the power cord, re-seat the memory modules, and reboot the computer. 3. If the memory configuration was recently changed, unplug the computer, restore the original memory configuration, and reboot the computer. 4. If the error persists, replace the system board.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
2201-MEBx Module did not checksum correctly	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	1. Reboot the computer. 2. Unplug the power cord, re-seat the memory modules, and reboot the computer. 3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer. 4. If the error persists, replace the system board.
2202-PMM Deallocation Error during MEBx cleanup	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	1. Reboot the computer. 2. Unplug the power cord, re-seat the memory modules, and reboot the computer. 3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer. 4. If the error persists, replace the system board.
2203-Setup error during MEBx execution	MEBx selection or exit resulted in a setup failure.	1. Reboot the computer. 2. Unplug the power cord, re-seat the memory modules, and reboot the computer. 3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer. 4. If the error persists, replace the system board.
2204-Inventory error during MEBx execution	BIOS information passed to the MEBx resulted in a failure.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version. 3. If the error still persists, replace the system board.
2205-Interface error during MEBx execution	MEBx operation experienced a hardware error during communication with ME.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version. 3. If the error still persists, replace the system board.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
2211-Memory not configured correctly for proper MEBx execution.	DIMM1 or XMM1 is not installed.	Make sure there is a memory module in the black DIMM1 socket and that it is properly seated.
2212-USB Key Provisioning failure writing to device	USB device used for USB key provisioning will not allow BIOS to update provision file properly.	1. Try a different USB key device for provisioning. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2217-ME Firmware Version request failure	ME firmware is not properly responding to BIOS query for version information.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2218-ME Firmware Version should be updated	ME firmware must be updated to match current functionality contained in the system BIOS.	1. Update to the latest ME firmware version. 2. If the error persists and system BIOS has been recently updated, restore previous system BIOS version. 3. If the error still persists, replace the system board.
2219-USB Key Provisioning file has invalid header identifier	Provisioning file contained on the USB key has been corrupted or is not a valid version for the current ME firmware.	1. Recreate the provisioning file using third party management console software. 2. If the error persists and system BIOS has been recently updated, restore previous system BIOS version. Otherwise, update the ME firmware version. 3. If the error still persists, replace the system board.
2220-USB Key Provisioning file has mismatch version	Provisioning file contained on the USB key is not a valid version for the current ME firmware.	1. Reboot the computer. 2. If the error persists and system BIOS has been recently updated, restore previous system BIOS version. Otherwise, update the ME firmware version. 3. If the error still persists, replace the system board.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
2230-General error during MEBx execution	Error occurred during MEBx execution which fails into the “General” grouping. Status information displayed along with the error provides further clarity into the failure. MEBx handles transference of information between the system BIOS and ME firmware.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2231-ME error during MEBx execution	Error occurred during MEBx execution which fails into “ME” grouping.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2232-AMT error during MEBx execution	Error occurred during MEBx execution which fails into “AMT” grouping.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2233-HECI error during MEBx execution	Error occurred during MEBx execution which fails into “MEI or HECI” grouping.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2239-ME image lock failure	Special system configurations with reduced ME firmware image require BIOS control of ME firmware upgrading. A failure has occurred after the ME firmware update process in which the BIOS could not relock the ME firmware region.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
2240-ME image unlock failure	Special system configurations with reduced ME firmware image require BIOS control of ME firmware upgrading. A failure has occurred prior to the ME firmware update process in which the BIOS could not unlock the ME firmware region.	1. Reboot the computer. 2. If the error persists, update to the latest BIOS version and ME firmware version. 3. If the error still persists, replace the system board.
Invalid Electronic Serial Number	Electronic serial number is missing.	Enter the correct serial number in Computer Setup.

Table C-1 Numeric Codes and Text Messages (continued)

Control panel message	Description	Recommended action
Network Server Mode Active and No Keyboard Attached	Keyboard failure while Network Server Mode enabled.	1. Reconnect keyboard with computer turned off. 2. Check connector for bent or missing pins. 3. Ensure that none of the keys are depressed. 4. Replace keyboard.
Parity Check 2	Parity RAM failure.	Run Computer Setup and Diagnostic utilities.

Interpreting POST Diagnostic Front Panel LEDs and Audible Codes

This section covers the front panel LED codes as well as the audible codes that may occur before or during POST that do not necessarily have an error code or text message associated with them.

⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

NOTE: If you see flashing LEDs on a PS/2 keyboard, look for flashing LEDs on the front panel of the computer and refer to the following table to determine the front panel LED codes.

Recommended actions in the following table are listed in the order in which they should be performed.

Not all diagnostic lights and audible codes are available on all models.

Table C-2 Diagnostic Front Panel LEDs and Audible Codes

Activity	Beeps	Possible Cause	Recommended Action
Green Power LED On.	None	Computer on.	None
Green Power LED flashes every two seconds.	None	Computer in Suspend to RAM mode (some models only) or normal Suspend mode.	None required. Press any key or move the mouse to wake the computer.

Table C-2 Diagnostic Front Panel LEDs and Audible Codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes two times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	2	Processor thermal protection activated: A fan may be blocked or not turning. OR The heat sink/fan assembly is not properly attached to the processor.	1. Ensure that the computer air vents are not blocked and the processor cooling fan is running. 2. Open hood, press power button, and see if the processor fan spins. If the processor fan is not spinning, make sure the fan's cable is plugged onto the system board header. 3. If fan is plugged in, but is not spinning, then replace heat sink/fan assembly. 4. Contact an authorized reseller or service provider.
Red Power LED flashes three times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	3	Processor not installed (not an indicator of bad processor).	1. Check to see that the processor is present. 2. Reseat the processor.
Red Power LED flashes four times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	4	Power failure (power supply is overloaded). OR The incorrect external power supply adapter is being used on the USDT.	1. Open the hood and ensure the 4 or 6-wire power supply cable is seated into the connector on the system board. 2. Check if a device is causing the problem by removing ALL attached devices (such as hard, diskette, or optical drives, and expansion cards). Power on the system. If the system enters the POST, then power off and replace one device at a time and repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly. 3. Replace the power supply. 4. Replace the system board. OR The USDT power supply adapter must be at 135W and use the Smart ID technology before the system will power up. Replace the power supply adapter with the HP-supplied USDT power supply adapter.

Table C-2 Diagnostic Front Panel LEDs and Audible Codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes five times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	5	Pre-video memory error.	**CAUTION:** To avoid damage to the DIMMs or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a DIMM module. 1. Reseat DIMMs. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.
Red Power LED flashes six times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	6	Pre-video graphics error.	For systems with a graphics card: 1. Reseat the graphics card. 2. Replace the graphics card. 3. Replace the system board. For systems with integrated graphics, replace the system board.
Red Power LED flashes seven times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	7	System board failure (ROM detected failure prior to video).	Replace the system board.
Red Power LED flashes eight times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	8	Invalid ROM based on bad checksum.	1. Reflash the system ROM with the latest BIOS image. See the “Boot Block Emergency Recovery Mode” section of the *Desktop Management Guide* for more information. 2. Replace the system board.
Red Power LED flashes nine times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	9	System powers on but is unable to boot.	1. Check that the voltage selector, located on the rear of the power supply (some models), is set to the appropriate voltage. Proper voltage setting depends on your region. 2. Unplug the AC power cord from the computer, wait 30 seconds, then plug the power cord back in to the computer. 3. Replace the system board. 4. Replace the processor.

Table C-2 Diagnostic Front Panel LEDs and Audible Codes (continued)

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes ten times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	10	Bad option card.	1. Check each option card by removing the card (one at a time if multiple cards), then power on the system to see if fault goes away. 2. Once a bad card is identified, remove and replace the bad option card. 3. Replace the system board.
Red Power LED flashes eleven times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	11	The current processor does not support a feature previously enabled on this system.	1. Install a TXT capable processor. 2. Disable TXT in the Computer Setup (F10) utility. 3. Reinstall the original processor.
System does not power on and LEDs are not flashing.	None	System unable to power on.	Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, the power button is working correctly. Try the following: 1. Check that the voltage selector (some models), located on the rear of the power supply, is set to the appropriate voltage. Proper voltage setting depends on your region. 2. Replace the system board. OR Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then: 1. Check that the unit is plugged into a working AC outlet. 2. Open hood and check that the power button harness is properly connected to the system board. 3. Check that both power supply cables are properly connected to the system board. 4. Check to see if the 5V_aux light on the system board is turned on. If it is turned on, then replace the power button harness. If the problem persists, replace the system board. 5. If the 5V_aux light on the system board is not turned on, remove the expansion cards one at a time until the 5V_aux light on the system board turns on. It the problem persists, replace the power supply.

D Password Security and Resetting CMOS

This computer supports security password features, which can be established through the Computer Setup Utilities menu.

This computer supports two security password features that are established through the Computer Setup Utilities menu: setup password and power-on password. When you establish only a setup password, any user can access all the information on the computer except Computer Setup. When you establish only a power-on password, the power-on password is required to access Computer Setup and any other information on the computer. When you establish both passwords, only the setup password will give you access to Computer Setup.

When both passwords are set, the setup password can also be used in place of the power-on password as an override to log in to the computer. This is a useful feature for a network administrator.

If you forget the password for the computer, you can clear that password so you can gain access to the information on the computer by resetting the password jumper.

⚠ **CAUTION:** Pushing the CMOS button will reset CMOS values to factory defaults. It is important to back up the computer CMOS settings before resetting them in case they are needed later. Back up is easily done through Computer Setup. See Computer Setup (F10) Utility on page 16 for information on backing up the CMOS settings.

Resetting the Password Jumper

To disable the power-on or setup password features, or to clear the power-on or setup passwords, complete the following steps:

1. Shut down the operating system properly, then turn off the computer and any external devices, and disconnect the power cord from the power outlet.
2. With the power cord disconnected, press the power button again to drain the system of any residual power.

WARNING! To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet, and allow the internal system components to cool before touching.

CAUTION: When the computer is plugged in, the power supply always has voltage applied to the system board even when the unit is turned off. Failure to disconnect the power cord can result in damage to the system.

Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. See the *Safety & Regulatory Information* guide for more information.

3. Remove the computer cover or access panel.
4. Locate the header and jumper.

NOTE: The password jumper is green so that it can be easily identified. For assistance locating the password jumper and other system board components, see the Illustrated Parts & Service Map (IPSM). The IPSM can be downloaded from http://www.hp.com/support.

5. Remove the jumper from pins 1 and 2. Place the jumper on either pin 1 or 2, but not both, so that it does not get lost.
6. Replace the computer cover or access panel.
7. Reconnect the external equipment.
8. Plug in the computer and turn on power. Allow the operating system to start. This clears the current passwords and disables the password features.
9. To establish new passwords, repeat steps 1 through 4, replace the password jumper on pins 1 and 2, then repeat steps 6 through 8. Establish the new passwords in Computer Setup.

Clearing and Resetting the CMOS

The computer's configuration memory (CMOS) stores information about the computer's configuration.

The CMOS button resets CMOS but does not clear the power-on and setup passwords.

Clearing CMOS will clear the Active Management Technology (AMT) settings in the Management Engine BIOS Extension (MEBx), including the password. The password will default to "admin" and will need to be reset. The AMT settings will also need to be reset. To access the MEBx, press Ctrl+P during POST.

1. Turn off the computer and any external devices, and disconnect the power cord from the power outlet.
2. Disconnect the keyboard, monitor, and any other external equipment connected to the computer.

WARNING! To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet, and allow the internal system components to cool before touching.

CAUTION: When the computer is plugged in, the power supply always has voltage applied to the system board even when the unit is turned off. Failure to disconnect the power cord can result in damage to the system.

Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. See the *Safety & Regulatory Information* guide for more information.

3. Remove the computer cover or access panel.

CAUTION: Pushing the CMOS button will reset CMOS values to factory defaults. It is important to back up the computer CMOS settings before resetting them in case they are needed later. Back up is easily done through Computer Setup. See Computer Setup (F10) Utility on page 16 for information on backing up the CMOS settings.

4. Locate, press, and hold the CMOS button in for five seconds.

NOTE: Make sure you have disconnected the AC power cord from the wall outlet. The CMOS button will not clear CMOS if the power cord is connected.

Figure D-1 CMOS button

NOTE: For assistance locating the CMOS button and other system board components, see the Illustrated Parts & Service Map (IPSM).

5. Replace the computer cover or access panel.
6. Reconnect the external devices.
7. Plug in the computer and turn on power.

NOTE: You will receive POST error messages after clearing CMOS and rebooting advising you that configuration changes have occurred. Use Computer Setup to reset any special system setups along with the date and time.

For instructions on Computer Setup, see Computer Setup (F10) Utility on page 16.

E Drive Protection System (DPS)

The Drive Protection System (DPS) is a diagnostic tool built into the hard drives installed in some computers. DPS is designed to help diagnose problems that might result in unwarranted hard drive replacement.

When these systems are built, each installed hard drive is tested using DPS, and a permanent record of key information is written onto the drive. Each time DPS is run, test results are written to the hard drive. Your service provider can use this information to help diagnose conditions that caused you to run the DPS software.

Running DPS will not affect any programs or data stored on the hard drive. The test resides in the hard drive firmware and can be executed even if the computer will not boot to an operating system. The time required to execute the test depends on the manufacturer and size of the hard drive; in most cases, the test will take approximately two minutes per gigabyte.

Use DPS when you suspect a hard drive problem. If the computer reports a SMART Hard Drive Detect Imminent Failure message, there is no need to run DPS; instead, back up the information on the hard drive and contact a service provider for a replacement hard drive.

Accessing DPS Through Computer Setup

When the computer does not power on properly you should use Computer Setup to access the DPS program. To access DPS, perform the following steps:

1. Turn on or restart the computer.
2. When the F10 Setup message appears in the lower-right corner of the screen, press the F10 key.

NOTE: If you do not press the F10 key while the message is displayed, you must turn the computer off, then on again, to access the utility.

A choice of five headings appears in the Computer Setup Utilities menu: **File**, **Storage**, **Security**, **Power**, and **Advanced**.

3. Select **Storage** > **DPS Self-Test**.

The screen will display the list of DPS-capable hard drives that are installed on the computer.

NOTE: If no DPS-capable hard drives are installed, the **DPS Self-Test** option will not appear on the screen.

4. Select the hard drive to be tested and follow the screen prompts to complete the testing process.

When the test has been completed, one of three messages will be displayed:

- Test Succeeded. Completion Code 0.
- Test Aborted. Completion Code 1 or 2.
- Test Failed. Drive Replacement Recommended. Completion Code 3 through 14.

If the test failed, the completion code should be recorded and reported to your service provider for help in diagnosing the computer problem.

F Specifications

ms6200

Table F-1 Specifications

Chassis (in the desktop position)		
Height	4.0 in	10.0 cm
Width	13.3 in	33.8 cm
Depth	14.9 in	37.9 cm
Approximate Weight	16.7 lb	7.6 kg
Weight Supported (maximum distributed load in desktop position)	77 lb	35 kg
Temperature Range		
Operating	50° to 95°F	10° to 35°C
Nonoperating	-22° to 140°F	-30° to 60°C
NOTE: Operating temperature is derated 1.0° C per 300 m (1000 ft) to 3000 m (10,000 ft) above sea level; no direct sustained sunlight. Maximum rate of change is 10° C/Hr. The upper limit may be limited by the type and number of options installed.		
Relative Humidity (noncondensing)		
Operating	10-90%	10-90%
Nonoperating (38.7°C max wet bulb)	5-95%	5-95%
Maximum Altitude (unpressurized)		
Operating	10,000 ft	3048 m
Nonoperating	30,000 ft	9144 m
Power Supply		
Operating Voltage Range	90-264 VAC	
Rated Voltage Range[1]	100-240 VAC	
Rated Line Frequency	50-60 Hz	
Operating Line Frequency	47-63 Hz	
Standard Efficiency	240W active PFC	
High Efficiency	240W active PFC; 87/90/87% efficient at 20/50/100% load	

Table F-1 Specifications (continued)

Rated Input Current	4A

[1] This system utilizes an active power factor corrected power supply. This allows the system to pass the CE mark requirements for use in the countries of the European Union. The active power factor corrected power supply also has the added benefit of not requiring an input voltage range select switch.

t200 Specifications

Table F-2 t200 Zero Client

Dimensions		
Width (side to side)	136 mm	5.35 in.
Height (without mounting bracket)	35 mm	1.38 in
Height (with mounting bracket)	41 mm	1.61 in
Depth (front to back)	91 mm	3.58 in.
Approximate Weight		
Without mounting bracket	343 g	12.1 oz
With mounting bracket	381 g	13.44 oz
Temperature Range *		
Operating**	10° to 40° C	50° to 104° F
(max. rate of change is 10° C per hour or 18° F per hour)		
Nonoperating	-30° to 60° C	-22° to 140° F
(max. rate of change is 20° C per hour or 36° F per hour)		
*Specifications are at sea level with altitude derating of 1° C/300m (1.8° F/1000ft) to a maximum of 3Km (10,000ft), with no direct, sustained sunlight. Upper limit may be limited by the type and number of options installed.	** The operating temperature range when the t200 Zero Client is attached to a flat panel using the mounting bracket is 50° to 95° F (10° to 35° C).	
Relative Humidity (non-condensing)		
Operating	10–90%	10–90%
(max. wet bulb temperature is 28° C or 84.2° F)		
Nonoperating	5–95%	5–95%
(max. wet bulb temperature is 38.7° C or 101.6° F)		
Maximum Altitude (unpressurized)		
Operating	3,048 m	10,000 ft
(max. allowed rate of change is 457 m per minute or 1500 ft per minute)		
Nonoperating	9,144 m	30,000 ft
(max. allowed rate of change is 457 m per minute or 1500 ft per minute)		

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